SOIL SURVEY

Okmulgee County Oklahoma

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
OKLAHOMA AGRICULTURAL EXPERIMENT STATION
Issued May 1968

Major fieldwork for this soil survey was done in the period 1957-63. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1963. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station; it is part of the technical assistance furnished to the Okmulgee County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, or other structures; and in appraising the value of tracts of land for agriculture, industry, or recreation.

Locating Soils

All of the soils of Okmulgee County are shown on the detailed map at the back of this survey. This map consists of many sheets that were made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, range site, and post-lot and windbreak group in which each soil has been placed.

Individual colored maps showing the relative suitability or limitation of soils for many specific purposes other than cultivated crops, range, and post lots and windbreaks can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and ranchers and those who work with them can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and post-lot and windbreak groups.

Game managers, sportsmen, and others concerned with wildlife will find information about soils and wildlife in the section "Wildlife."

Engineers and builders will find under "Engineering Properties of the Soils" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Genesis, Classification, and Morphology of the Soils."

Students, teachers, and others will find information about soils and their management in various parts of the text.

Newcomers in Okmulgee County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County."

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Contents

NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued May 1968

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas and Eldorado Valleys Area, Nev.
Series 1958, No. 34, Grand Traverse County, Mich.
Series 1959, No. 42, Judith Basin Area, Mont.
Series 1960, No. 31, Elbert County, Colo. (Eastern Part)
Series 1961, No. 42, Camden County, N.J.
Series 1962, No. 13, Chicot County, Ark.
Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF OKMULGEE COUNTY, OKLAHOMA

BY W. A. SPARWASSER, VINSON A. BOGARD, AND ODOS G. HENSON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE OKLAHOMA AGRICULTURAL EXPERIMENT STATION

OKMULGEE COUNTY is in the east-central part of Oklahoma (fig. 1). The area totals about 700 square miles. Okmulgee, near the center of the county, is the County seat.

The major industries are agriculture, oil production, and glass manufacture. There are producing oil wells in nearly all parts of the county, an oil refinery at Okmulgee, glass manufacturing plants at Okmulgee and Henryetta, and a lead and zinc smelter at Henryetta. Coal mining, once a major industry, is now represented only by a few small mines producing for local needs.

Transportation in the county is provided by a good airport near Okmulgee, a good highway system, and two major railroads.

General Nature of the County

In the first half of the 19th century, agriculture was brought to what is now Okmulgee County by the first settlers, who were Creek Indians. These Indians did not own land individually but built on, improved, and cultivated any unused tribal land. Generally, they cultivated only enough corn and other produce for their own needs. A few Indians cultivated large acreages and sold corn and other produce to the U.S. Army and to the few established trading posts. Later, other settlers came, attracted by surplus Indian land and the boom caused by the discovery of oil in 1907. This boom reached its climax in the twenties, and since then the oil industry has been a major and continuing influence.

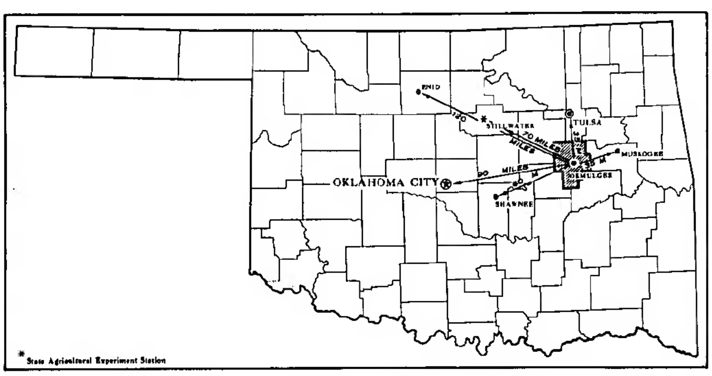

Figure 1.—**Location of Okmulgee County in Oklahoma.**

There have always been a few large ranches in Okmulgee County, but until about 1940, most farms were between 40 and 60 acres in size. Most farmers were tenants who grew most of the food for their families as well as the feed for their livestock. They grew corn, oats, hay, and, as a cash crop, a little cotton, and they raised a few cows, hogs, and chickens. They sold garden produce, dairy products, and poultry and other meat not used by the family, as well as the grain and hay not needed for feed.

By 1960 the farm population, shown in table 1, was only about a third of what it had been in 1950, there were less than half as many farms, and the average size of farms had more than doubled. About 80 percent of the farmers were owners, and about half were employed off the farm at least a hundred days a year. A number of them were employed in drilling, pumping, and servicing oil wells. Table 2 shows the acreage of hay and cultivated crops grown in 1950 and 1960.

TABLE 1.—*Population of Okmulgee County in 1950 and 1960*

[Data from U.S. Agriculture Census reports]

Population group	1950	1960
	Number	*Number*
Urban	26, 305	22, 502
Rural farm	9, 122	2, 925
Rural nonfarm	9, 135	11, 518
Total rural	18, 257	14, 443
Total county	44, 561	36, 945

At present more land is used for raising beef cattle than for growing crops. Nearly half the county is not suitable for cultivation and is used mostly as native grass range, but a large acreage that could be cultivated is also used for range, tame pasture, and hay crops. There are several purebred and registered beef herds, mostly of Herefords or Angus. There are also a few dairy herds, mostly of good grade Holstein-Fresians.

Pecans, mostly harvested from native trees, are an important cash crop. Improved varieties have been planted in a few orchards, but native pecans bring the same price and under like management the native trees produce as much as the improved varieties.

TABLE 2.—*Acreage of principal crops in 1950 and 1960*

[Source: Farm reports of the Oklahoma Crop and Livestock Reporting Service]

Crop	1950	1960
	Acres	*Acres*
Cotton	22, 000	4, 850
Corn	28, 400	6, 900
Oats	11, 000	2, 000
Peanuts	5, 000	1, 630
Forage sorghum	2, 900	2, 000
Grain sorghum	1, 900	3, 900
Wheat	600	1, 000
Alfalfa hay	500	1, 000
Prairie hay	13, 900	9, 900

Physiography, Relief, and Drainage

Okmulgee County is mostly prairie and lies almost entirely within the Cherokee Prairies land resource area. Overall, it slopes very gently to the south and east. The praries originally had a cover of tall grass, but other areas were predominantly forested. The forests consisted of blackjack oak, post oak, and hickory on the sandier ridges; oaks on the sandy terraces along the Deep Fork Canadian River (also called the Deep Fork River), and various deciduous trees on the bottoms along other streams. The elevation ranges from about 1,000 feet in the northwestern corner to about 590 feet on the southeastern edge.

The relief is characterized by sandstone ridges and broad valleys that extend from southwest to northeast. The ridges are very gently sloping to steep, and the valleys are gently sloping to nearly level.

Most of the county is drained by the Deep Fork Canadian River, which flows from the central western edge southeast to the eastern edge and eventually into the North Canadian River at a point several miles east of the county line. The northeastern third is drained by creeks that flow to the north and east. Two small areas in the southeastern and southwestern corners are drained by the North Canadian River, which flows across the county at the far southeastern corner. All these streams are tributaries of the Arkansas River.

Geology, Natural Resources, and Water

The geologic formations (fig. 2) that are at the surface or immediately beneath the soils in Okmulgee County are of sedimentary origin. Except for Recent alluvium and Quaternary terrace deposits, these formations belong to the Pennsylvanian system.

The Pennsylvanian formations, except for Hogshooter limestone and Checkerboard limestone, consist mostly of sandstone and shale. Several of these formations contain beds of sandy limestone in a few places, but the beds are generally less than 1 foot thick and of small extent. The sandstone makes up long, conspicuous ridges that extend across the county in a northeasterly direction, but the shale is so easily weathered to clay that it is seldom seen except in mines or wells. Consolidated Pennsylvanian rocks of the uplands were deposited in nearly level layers, were later raised and tilted, and now slope to the northwest. The gradient is between 20 and 60 feet a mile; the slope is steeper in the western part of the county than in the eastern part.

Only a small part of the Pennsylvanian rocks in the county are completely bare. Most of the rocks are covered by loose colluvium. This colluvium ranges from a few inches to many feet in thickness and generally has not moved very far downhill, perhaps only a hundred feet.

The Quaternary terrace deposits are soft, unconsolidated remnants of rock debris derived from Pennsylvanian rocks, mostly sandstone and shale. These deposits once filled the valleys but are now high along the flanks of the hills and on some of the lower parts of the uplands. The Recent alluvium is much younger than the terrace deposits and is made up of debris washed from areas of these deposits and from the higher areas of the Pennsylvanian formations.

Wind-deposited material has covered and has been mixed with the colluvial material covering the Pennsylvanian rocks and with the alluvial material of the Quaternary and Recent formations.

Soils of the Konawa-Stidham soil association and the Verdigris-Lightning-Pulaski soil association developed in alluvium of the Quaternary system. The soils in all other associations of the county developed in material weathered from formations of the Pennsylvanian system. Table 3 shows the material in which the soils of each association developed and the major geologic formations on which each association occurs.

The consolidated rock on the uplands in Okmulgee County is so fine grained that water seeps through it very slowly, and cracks and crevices in the rock are so scarce and so hard to find that drilling wells is not practical. Wells in the alluvium near streams yield more water,

TABLE 3.—*Relationship of soils, by associations, to geologic formations*

Soil association	Dominant soils developed in—	Geologic system and major formations
Dennis-Bates-Parsons.	Residuum from silty shale and sandstone.	Pennsylvanian system: Wewoka, Senora, Coffeyville, Holdenville, and Calvin formations.
Taloka	Loess over silty shale.	Pennsylvanian system: Senora formation.
Okemah-Woodson	Residuum from calcareous shale, clay, and limestone.	Pennsylvanian system: Checkerboard, Hogshooter, Senora, Coffeyville, and Seminole formations.
Collinsville-Talihina.	Residuum from sandstone and calcareous shale and clay.	Pennsylvanian system: Senora, Calvin, Wewoka, Holdenville, and Coffeyville formations.
Hector-Hartsells	Residuum from coarse-grained sandstone.	Pennsylvanian system: Wewoka, Calvin, and Nellie Bly formations.
Konawa-Stidham	Sandy alluvium	Quaternary system: Terrace deposits.
Verdigris-Lightning-Pulaski.	Recent alluvium	Quaternary system: Alluvium.

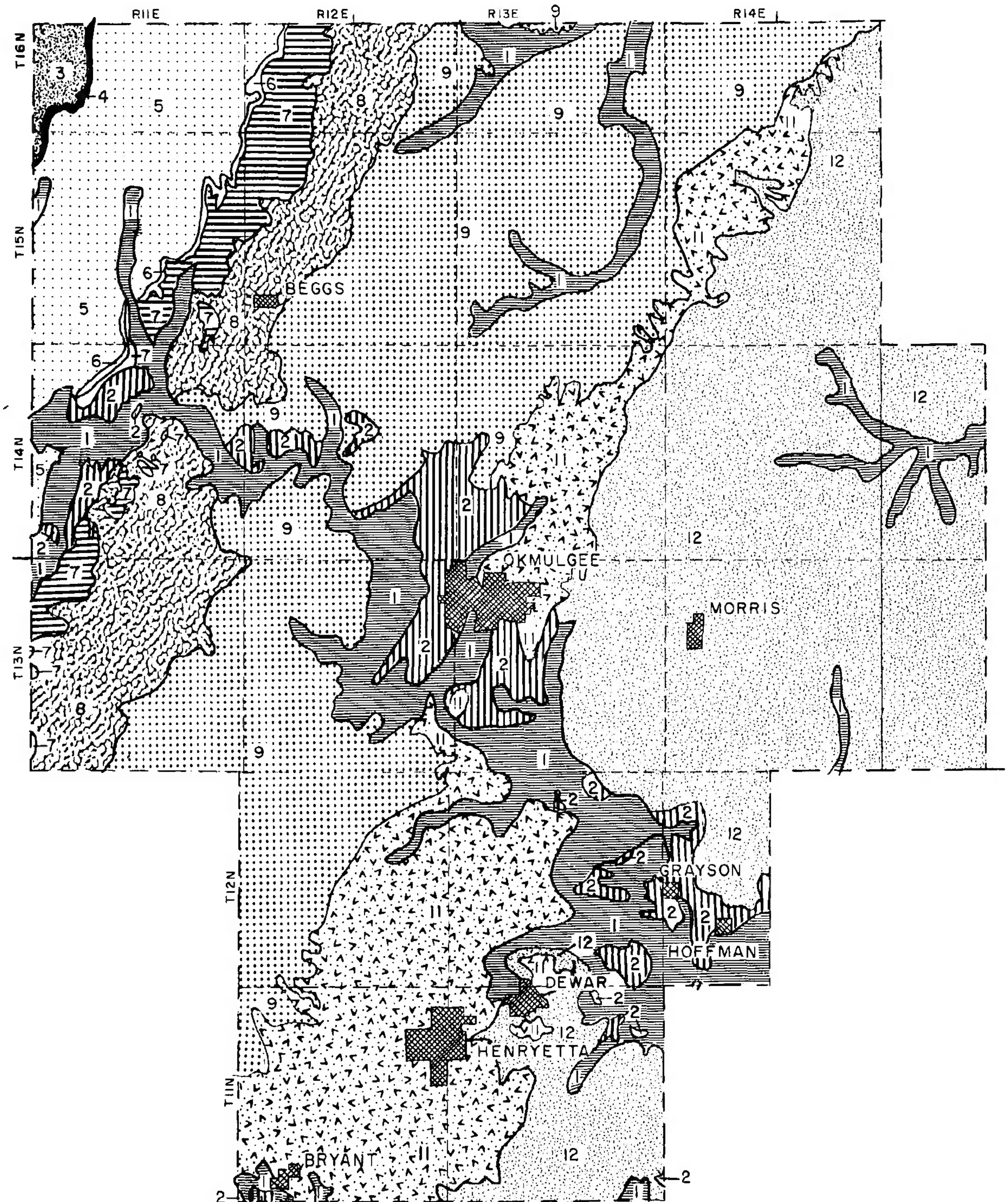

Figure 2.—Map of Okmulgee County showing geologic formations at the surface or directly below the soils. The formations, in order of youngest to oldest, are as follows: 1, Recent alluvium; 2, Quaternary terrace deposits; 3, Nellie Bly formation; 4, Hogshooter limestone; 5, Coffeyville formation; 6, Checkerboard limestone; 7, Seminole formation; 8, Holdenville formation; 9, Wewoka formation; 11, Calvin sandstone; and 12, Senora formation. (Based on map furnished by Malcolm C. Oakes, geologist, Oklahoma Geological Survey.)

but even these produce no large amount. Much of the ground water contains large quantities of minerals, either naturally or as a result of contamination from oil wells. Nevertheless, wells are the source of most of the water used on farms in this county. Towns and industries that use large amounts of water depend on storage of surface water, and even on farms rainwater stored in stream channels and small ponds is being used more and more to supplement the water from wells.

Climate[1]

Okmulgee County has a temperate, continental climate of the moist, subhumid type. As the movement of warm, moisture-laden air from the Gulf of Mexico alternates with the movement of either cool, dry air from the West Coast or cold, dry air from around the Arctic Circle, significant fluctuations in temperature, cloudiness, wind, and precipitation take place.

The changes between seasons are gradual, but each season has well-defined characteristics that vary only in intensity from year to year. The open, sunny winters are broken occasionally by periods of cold blustery weather. Spring is the wettest season and the season when crops and pasture plants grow most rapidly. It is also the season when severe local storms and tornadoes are most likely to occur. In summer the rainfall is normally adequate for growing crops, and the long hot spells are eased by cool nights and a good breeze. The weather in fall is favorable for fall-seeded grains and for pasture. It is characterized by mild sunny weather interspersed with periods of cool weather and gentle, soaking rain.

Table 4 shows, by months, the average daily maximum temperature, the average daily minimum temperature, and the average precipitation. Table 5 shows the probabilities of freezing temperatures in spring and fall.

Okmulgee County has an average annual temperature of 61.2° F. and average monthly temperatures ranging from 29.0° in January to 81.9° in July. The average daily variation is 24.4°. Freezing temperatures occur on an average of 75 days a year, between October and April, and on 5 of these days the temperature does not go above freezing. Temperatures of 0 or below occur in only 1 year out of 3. Okmulgee has an average annual total of 3,372 degree days, ranging from none during the period June through August to a maximum of 794 during January. Temperatures of 90° or above occur on an average of 77 days a year, between March and October, and temperatures of 100° or above on an average of 15 days a year, from June through September.

Table 5 indicates that winter weather usually prevails from the last part of October through the early part of April. The average frost-free season, or growing season, ranges from about 212 days at Okmulgee to about 218 days in the southwestern part of the county. A freeze has occurred as late in spring as April 26 and as early in fall as October 7.

Evaporation is a problem only during dry spells in summer. The average annual lake evaporation is 53 inches, and 71 percent of this takes place in the period May to October.

The average precipitation is 38 inches a year in the northwestern corner of the county and 41 inches in the

[1] By Stanley G. Holbrook, State climatologist, U.S. Dept. of Commerce, Weather Bureau.

TABLE 4.—*Temperature and precipitation data*

[All data from Okmulgee, Okmulgee County, Okla.; based on records for the period 1931–60]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—: Maximum temperature equal to or higher than—	Two years in 10 will have at least 4 days with—: Minimum temperature equal to or lower than—	Average total	One year in 10 will have—: Less than—	One year in 10 will have—: More than—	Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
	°F.	°F.	°F.	°F.	In.	In.	In.		In.
January	50.7	28.1	68	11	1.97	0.4	3.7	2	3
February	55.1	31.6	73	16	2.21	.9	4.3	1	2
March	63.0	38.2	79	23	2.84	.4	6.5	1	4
April	73.2	49.5	85	34	4.58	1.8	9.0	0	
May	80.1	57.7	90	45	5.63	1.5	12.1	0	
June	88.7	66.8	100	57	5.63	1.6	13.0	0	
July	93.7	70.1	106	57	3.26	.8	7.4	0	
August	94.0	68.9	105	59	2.49	.4	5.2	0	
September	87.0	60.8	100	47	3.94	.6	7.8	0	
October	76.6	49.8	91	37	3.62	.6	6.1	0	
November	62.5	37.3	78	22	2.46	.2	5.1	(1)	1
December	53.4	31.0	70	12	2.05	.4	5.0	1	3
Year	73.2	49.2	[2] 104	[3] 4	40.68	24.7	57.3	5	3

[1] Less than 0.5 day. [2] Average annual highest temperature. [3] Average annual lowest temperature.

TABLE 5.—*Probabilities of freezing temperatures in spring and in fall*

[All data from Okmulgee, Okmulgee County; based on records for the period 1931–60]

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 7	March 16	March 28	April 9	April 14
2 years in 10 later than	February 26	March 9	March 22	April 4	April 10
5 years in 10 later than	February 11	February 23	March 11	March 24	April 1
Fall:					
1 year in 10 earlier than	November 26	November 20	November 1	October 22	October 13
2 years in 10 earlier than	December 3	November 26	November 8	October 28	October 19
5 years in 10 earlier than	December 15	December 7	November 21	November 8	October 30

southeastern part. The seasonal distribution—32 percent in spring, 28 percent in summer, 25 percent in fall, and 15 percent in winter—is favorable for agriculture. The most rainfall recorded in any single month was 21.27 inches, in October 1941; the most in a single day, 6.02 inches, in May 1943. In one 73-hour period in June 1948, 14.25 inches was recorded. Such hard rains usually result in erosion and flooding.

About 5 inches of snow falls each year in the southern part of the county, and about 6.3 inches in the northeastern part, but there is no snow in 1 winter out of 10. The heaviest snowfall in one winter was in 1957–58, when there was a total of 20.2 inches, 17.1 inches of which fell in December. The heaviest in a 24-hour period was on January 22, 1937; it totaled 10 inches. Even a heavy snow usually melts within 2 to 4 days, but in 1930 snow remained on the ground 22 days and was a record 11 inches deep on January 22 and 23.

The wind is northerly most of the time in January and February, but southerly winds prevail during the rest of the year. The average annual windspeed is about 11 miles an hour. The average monthly speed ranges from nearly 9 miles an hour in the period July through September to about 13 miles an hour in March. Winds of 25 to 45 miles an hour accompany the passage of most frontal systems, and gusts of 70 to 80 miles an hour accompany violent squalls and severe thunderstorms.

The most destructive storms are tornadoes, but since 1875 only 12 tornadoes have occurred in the county.

Only eight severe hailstorms have occurred since 1924. The only hailstorms recorded are those having hailstones at least three-fourths of an inch in diameter, and hailstones as large as 2 inches in diameter have been observed. There are 1.3 hailstorms per 100 square miles in Okmulgee County, compared with 4.3 hailstorms per 100 square miles in the western part of the State.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Okmulgee County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this survey efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Bates and Dennis, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the natural, undisturbed landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in the texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Bates loam and Bates fine sandy loam are two soil types in the Bates series. The difference in the texture of their surface layers is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Bates loam, 1 to 3 percent

slopes, is one of two phases of Bates loam, a soil type that has a slope range of 1 to 5 percent.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed or occur in individual areas of such small size that it is not practical to show them separately on the map. They show such a mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a complex is named for the major kinds of soil in it, for example, Bates-Collinsville fine sandy loams, 1 to 5 percent slopes.

Also, most surveys include areas in which the soil material is so rocky, so shallow, or so frequently worked by wind and water that it scarcely can be called soil. These areas are shown on the soil map like other mapping units, but they are given descriptive names, such as Broken alluvial land or Strip Mines, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey. On the basis of the yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, and then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this soil survey shows, in color, the soil associations in Okmulgee County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The seven associations in Okmulgee County are described in this section. More detailed information about the individual soils in each association can be obtained by studying the detailed map and by reading the section "Descriptions of the Soils."

1. Dennis-Bates-Parsons association

Nearly level or gently sloping, deep or moderately deep soils on prairie uplands

This association (fig. 3) consists of the prairie uplands. The soils are mostly deep or moderately deep and nearly level or gently sloping. They have a surface layer of loam or silt loam and a subsoil of clay loam or clay. These soils are underlain by silty shale, sandstone, clay, and, in places, old loess or alluvium over shale. This association makes up about 30 percent of the county.

Dennis soils are very gently sloping and gently sloping. They have a moderately thick, granular surface layer and a subsoil of heavy clay loam or light clay. These soils make up about 48 percent of association 1.

Bates soils are very gently sloping and gently sloping. They have a surface layer of loam and a subsoil of light clay loam. Sandstone commonly is at a depth of about 20 to 40 inches. These soils make up about 17 percent of this association.

Parsons soils are nearly level. They have an 8- to 16-inch surface layer of silt loam and a subsoil of compact clay. These soils make up about 11 percent of this association.

Small acreages of other soils, chiefly Collinsville, Dwight, Verdigris, and Mason soils, and of breaks and alluvial land, make up the rest of this association. Small areas have slopes steeper than are typical of this association.

About 28 percent of this association is cultivated. The rest is used for bermudagrass pasture and native grass pasture and meadow.

2. Taloka association

Nearly level, deep soils that have a thick surface layer, on prairie uplands

This association (fig. 4) consists of deep, nearly level soils of the prairie uplands. These soils formed in old

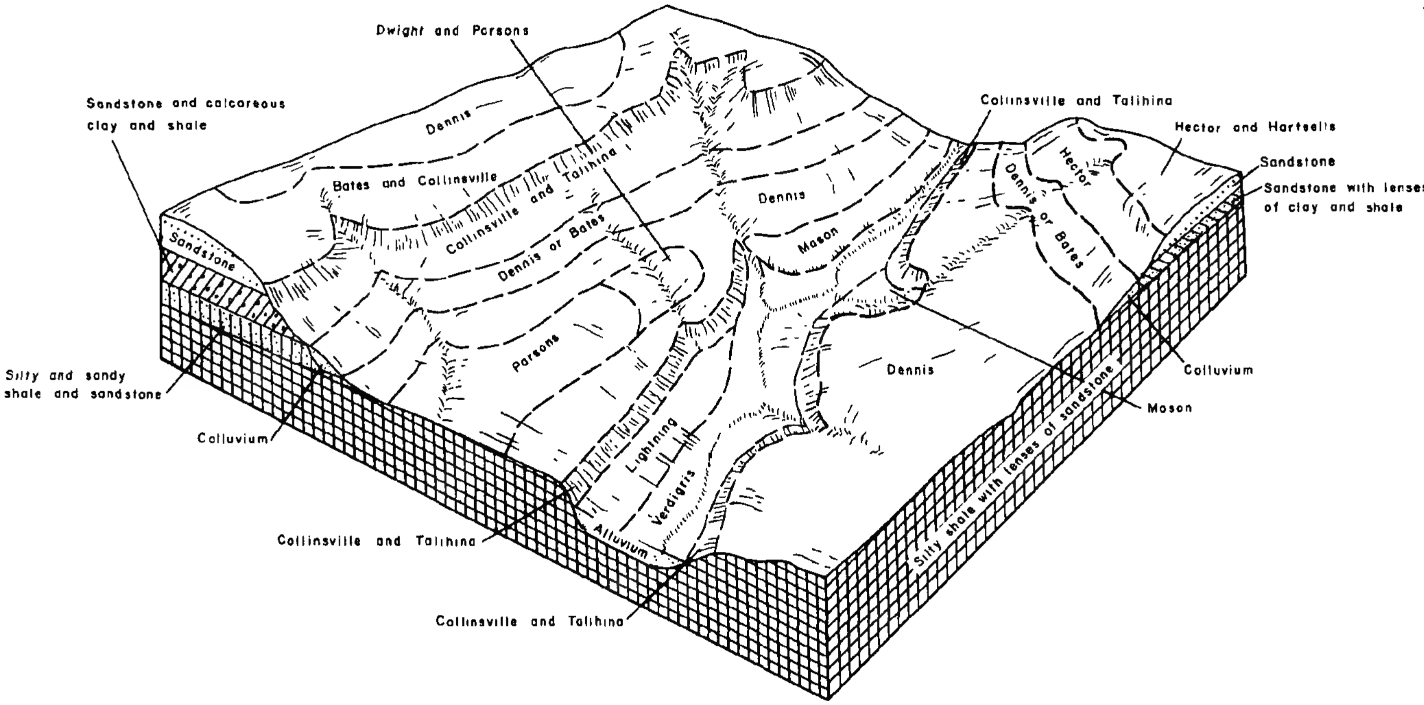

Figure 3. –Relationship of the Dennis, Bates, and Parsons soils to the soils of the Collinsville-Talihina and Hector-Hartsells associations.

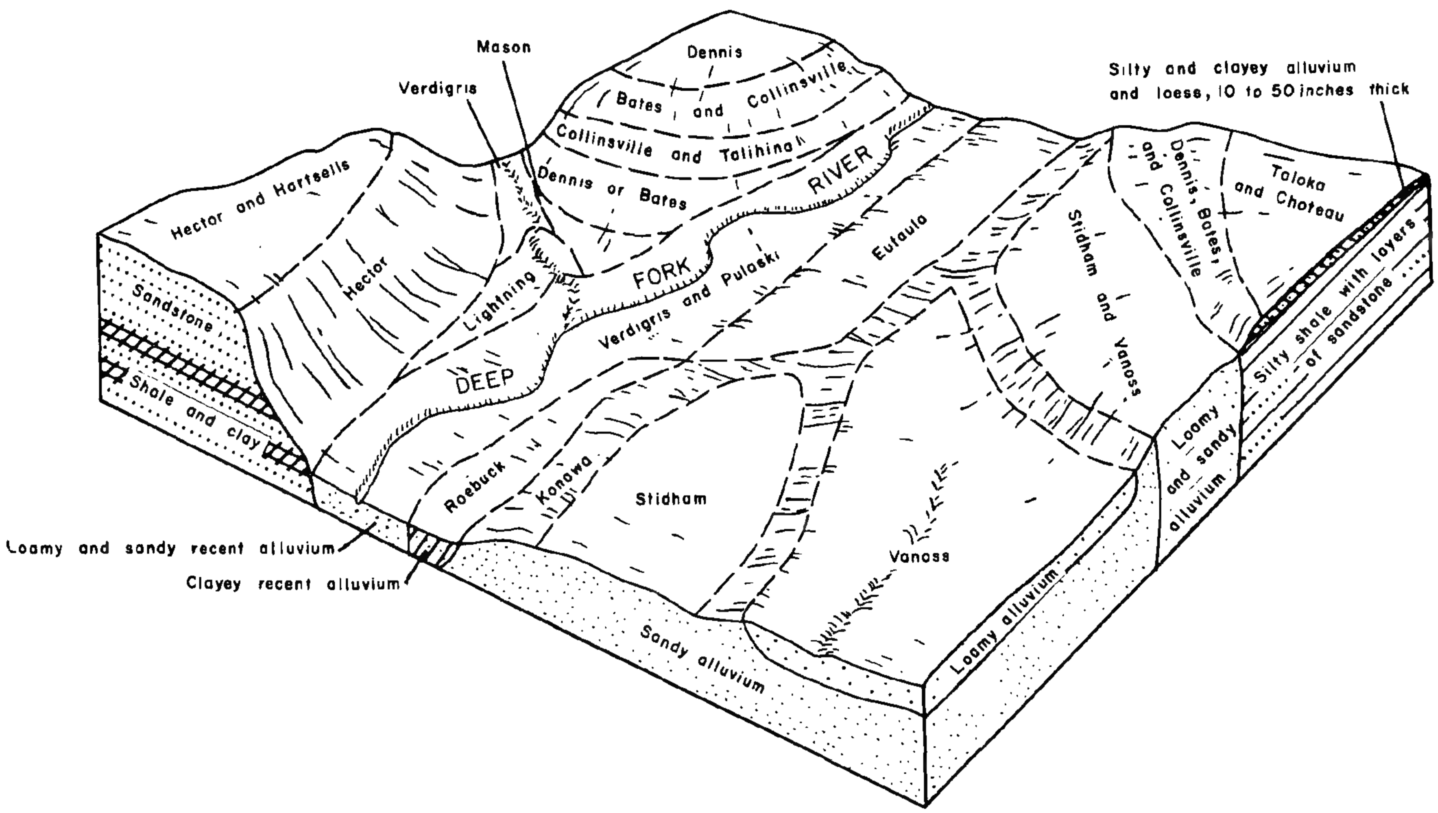

Figure 4.—Relationship of the Taloka and Choteau soils (upper right) to the soils of the Dennis-Bates-Parsons, Collinsville-Talihina, Hector-Hartsells, Konawa-Stidham, and Verdigris-Lightning-Pulaski associations. (The Deep Fork River is also known as the Deep Fork Canadian River.)

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loess or alluvium over silty shale. They have a thick surface layer of silt loam and a subsoil of clay or silty clay. This association is in the east-central part of the county and makes up about 10 percent of the county.

Taloka soils have long slopes of less than 2 percent. They have a thick surface layer of granular silt loam and a subsoil of compact clay or silty clay. These soils make up about 83 percent of association 2.

Choteau soils make up about 4 percent of this association. These soils are generally on low, very gently sloping ridges. They have a thick surface layer of granular loam and a subsoil of clay loam.

Small acreages of other soils, chiefly Dennis, Bates, Okemah, and Parsons soils, and of breaks and alluvial land, make up the rest of this association. Most of the coal strip mines in the county are in this association.

An estimated 46 percent of this association is cultivated. The rest is used for bermudagrass pasture and native grass pasture and meadow.

3. *Okemah-Woodson association*

Nearly level or very gently sloping, deep, dark-colored soils on prairie uplands

This association (fig. 5) consists of deep, nearly level or very gently sloping soils on prairie uplands. These soils have a surface layer of dark-gray silt loam, clay loam, or silty clay loam and a subsoil of compact clay that is slowly or very slowly permeable. They are underlain by calcareous shale and clay. This association is in the northern half of the county and makes up about 8 percent of the county.

Okemah soils are nearly level or very gently sloping. They have a granular surface layer of silt loam or clay loam. These soils make up about 62 percent of association 3.

Woodson soils are nearly level and moderately well drained. They have a surface layer of granular silty clay loam and a subsoil of dark-gray clay that is very slowly permeable. These soils make up about 9 percent of this association.

Eram soils occur with the very gently sloping Okemah soils. They make up about 6 percent of this association. Dwight, Dennis, Parsons, and Talihina soils and breaks and alluvial land make up the rest.

About 36 percent of this association is cultivated, a small acreage is used for bermudagrass pasture, and the rest is used for native grass pasture and meadow.

4. *Collinsville-Talihina association*

Strongly sloping to steep, shallow, stony soils on prairie uplands

This association consists of shallow soils on ridges and steep slopes. Most of the acreage is stony, and there are rock outcrops. Runoff is excessive. This association is most extensive in the southern and western parts of the county and makes up about 13 percent of the county.

Collinsville soils consist of about 15 inches or less of fine sandy loam over sandstone. They make up about 50 percent of association 4.

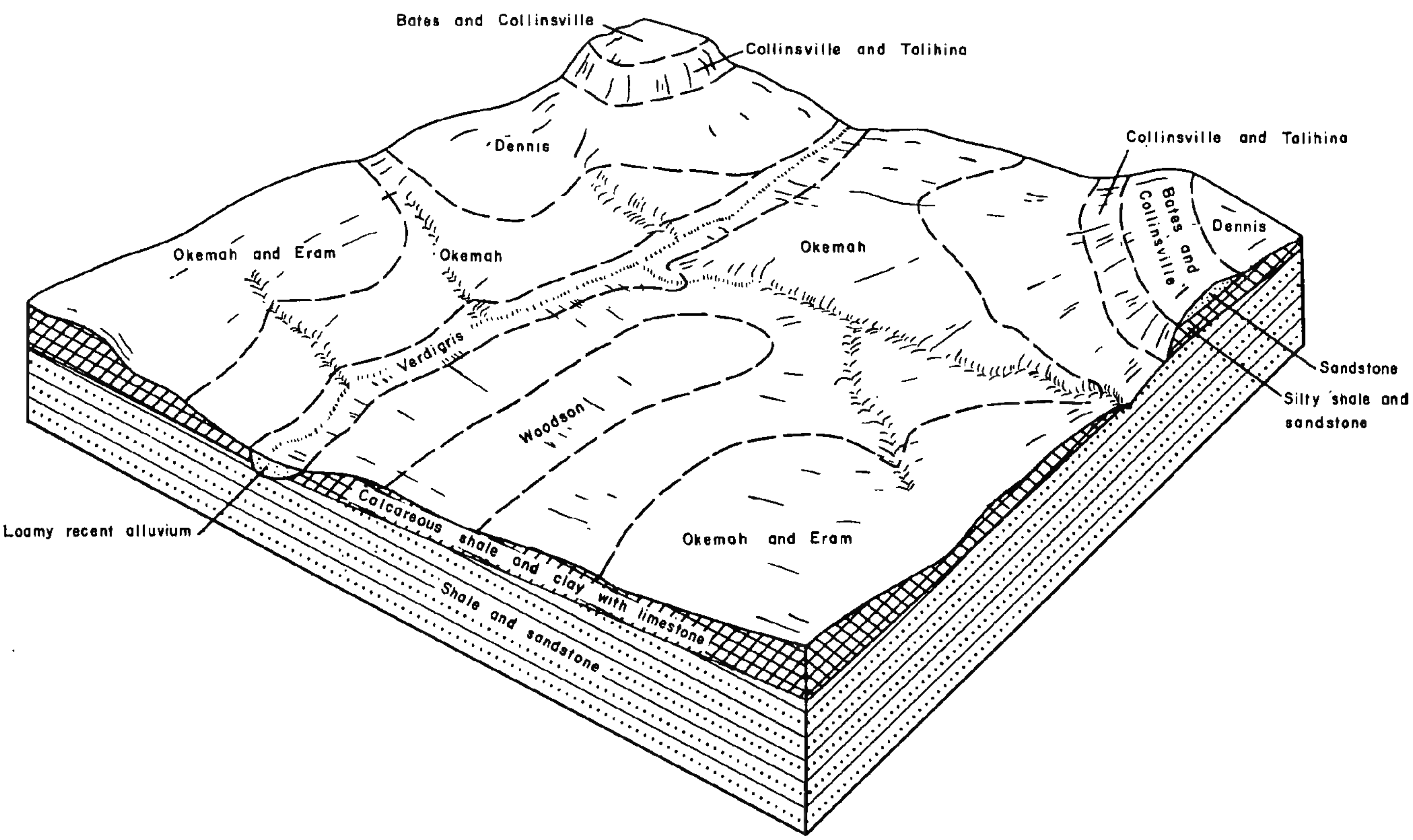

Figure 5.—**Soils of the Okemah-Woodson association.**

Talihina soils have a thin surface layer of clay over calcareous shale or clay. They are generally shallow. These soils make up about 30 percent of this association.

Small areas of Bates, Dennis, Eram, and other soils make up the rest of this association (see figures 3 and 5).

Most of this association is used for native grass pasture or for range, but a few of the least stony areas are used for hay. Less than 3 percent is cultivated.

5. Hector-Hartsells association

Very gently sloping to steep, shallow to moderately deep soils on forested uplands

This association consists of shallow to moderately deep, very gently sloping to very steep soils on forested uplands. These soils have a surface layer of fine sandy loam or stony sandy loam. In some areas the surface layer rests on sandstone; in other areas, it grades to sandy clay loam. About 78 percent of the acreage is stony, and there are many rock outcrops and steep bluffs. This association makes up about 23 percent of the county and is mostly in the central and western parts.

Hector soils are the steeper, stonier soils in this association. They have a 5- to 20-inch surface layer of fine sandy loam or stony sandy loam over sandstone. In many places the Hector and Hartsells soils are intermixed and are mapped as a complex of shallow and moderately deep soils. The Hector soils make up 75 percent of association 5.

Hartsells soils are very gently sloping to gently sloping. They have a surface layer of fine sandy loam and a subsoil of sandy clay loam. Depth to sandstone is generally about 36 inches. These soils make up about 12 percent of this association.

Small areas of Bates, Collinsville, Dennis, and other soils make up the rest of this association.

About 85 percent of this association is blackjack oak and post oak forest and is used as wooded pasture. As much as 15 percent has been cultivated, but not more than 5 percent is now cultivated.

6. Konawa-Stidham association

Nearly level to sloping, deep, light-colored, sandy soils on upland stream terraces

This association consists of deep, nearly level to sloping, sandy soils. The dominant soils have a surface layer of loamy fine sand and a subsoil of sandy clay loam. They are medium acid to very strongly acid. The vegetation under which they formed was mixed oak forest. This association is on high terraces along the Deep Fork Canadian River and makes up about 4 percent of the county.

Konawa soils are gently sloping or sloping. They have a surface layer of loamy fine sand and a subsoil of red sandy clay loam. More than a third of the acreage is severely gullied. These soils make up about 49 percent of association 6.

Stidham soils are nearly level. They have a surface layer of loamy fine sand and a subsoil of brownish-yellow to reddish-yellow sandy clay loam. These soils make up about 19 percent of this association.

Vanoss soils are nearly level or gently sloping. They have a surface layer of loam and a subsoil of clay loam. These soils are higher in fertility and have better water-holding capacity than Konawa and Stidham soils. Vanoss soils make up about 13 percent of this association.

Eufaula soils are nearly level. They have a surface layer of fine sand and show little evidence of subsoil development. They are low in fertility and have low water-holding capacity. These soils make up about 6 percent of this association.

Pulaski, Verdigris, Lightning, Mason, and other soils make up the rest of this association.

Most of this association is now idle land or low-quality pasture. About 40 percent has been cultivated, but only 14 percent is cultivated now.

7. Verdigris-Lightning-Pulaski association

Nearly level, deep, loamy soils on flood plains

This association consists of deep, well drained to poorly drained soils on the flood plains of the larger streams. Some areas of these soils are flooded frequently for periods of several days; others are flooded occasionally for only a few hours. They have a surface layer of fine sandy loam to clay. This association is along the larger streams and makes up about 12 percent of the county.

Verdigris soils are well drained. About 56 percent of the acreage is flooded occasionally, and 44 percent is flooded frequently. These soils have a surface layer of loam or silt loam and a subsurface layer of clay loam or silty clay loam. Verdigris and Pulaski soils are intermixed and are mapped as a complex. Verdigris soils make up about 50 percent of association 7.

Lightning soils are somewhat poorly drained. Most areas are flooded occasionally. These soils have a surface layer of silt loam and a subsoil of mottled clay at a depth of about 2 feet. They make up about 13 percent of this association.

Pulaski soils are flooded frequently. In most places the texture is fine sandy loam throughout the profile, but in some areas the profile is stratified with loamy fine sand, loam, or clay loam. These soils make up about 11 percent of this association.

Roebuck soils are in low areas or depressions on flood plains along the Deep Fork Canadian River. They are poorly drained and are flooded frequently. They have reddish-brown clay to a depth of 5 feet or more. These soils make up about 7 percent of this association.

Ochlockonee, Eufaula, Konawa, and other soils make up the rest of this association.

This association is used almost entirely for pasture and for pecan trees. Only about 9 percent is cultivated.

Descriptions of the Soils

In this section the soils of Okmulgee County are described in detail. The procedure is to describe first the soil series and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which the unit belongs.

The description of the soil series includes a description of a profile that is considered representative of all the soils of the series. If the profile of a given mapping

unit differs from this typical profile, the differences are stated in the description of the mapping unit, unless they are apparent from the name of the mapping unit. Many of the more common terms used in describing soil series and mapping units are defined in the Glossary, and some are defined in the section "How This Survey Was Made."

The approximate acreage and proportionate extent of the soils are shown in table 6. At the back of this soil survey is the "Guide to Mapping Units," which lists the mapping units in the county and shows the capability unit, range site, and post-lot and windbreak group each mapping unit is in and the page where each of these groups is described.

Bates Series

The Bates series consists of moderately deep, very gently sloping or gently sloping soils on uplands. These soils formed under grass, in material weathered from sandstone.

TABLE 6.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Bates loam, 1 to 3 percent slopes	5, 664	1. 3
Bates loam, 3 to 5 percent slopes	1, 171	. 3
Bates-Collinsville fine sandy loams, 1 to 5 percent slopes	31, 305	7. 0
Breaks-alluvial land complex	26, 588	5. 9
Broken alluvial land	12, 235	2. 7
Choteau loam, 1 to 3 percent slopes	1, 793	. 4
Collinsville-Talihina complex, 10 to 30 percent slopes	51, 740	11. 5
Dennis silt loam, 1 to 3 percent slopes	45, 149	10. 1
Dennis silt loam, 3 to 5 percent slopes	10, 830	2. 4
Dennis silt loam, 2 to 5 percent slopes, eroded	8, 835	2. 0
Dennis soils, 2 to 6 percent slopes, severely eroded	3, 546	. 8
Dougherty-Eufaula complex, rolling	791	. 2
Dwight-Parsons silt loams, 0 to 1 percent slopes	3, 690	. 8
Eufaula fine sand, undulating	1, 167	. 3
Hartsells fine sandy loam, 1 to 3 percent slopes	1, 750	. 4
Hector-Hartsells fine sandy loams, 1 to 5 percent slopes	16, 652	3. 7
Hector complex, 5 to 30 percent slopes	70, 316	15. 7
Konawa loamy fine sand, 3 to 8 percent slopes	5, 121	1. 1
Konawa loamy fine sand, 3 to 8 percent slopes, severely eroded	3, 306	. 7
Lightning silt loam	6, 653	1. 5
Mason loam	3, 589	. 8
Ochlockonee soils, wet	1, 919	. 4
Oil-Waste land	1, 712	. 4
Okemah silt loam, 0 to 1 percent slopes	10, 322	2. 3
Okemah silt loam, 1 to 3 percent slopes	12, 892	2. 9
Okemah-Eram clay loams, 1 to 3 percent slopes	6, 245	1. 4
Parsons silt loam, 0 to 1 percent slopes	9, 211	2. 0
Parsons silt loam, 1 to 3 percent slopes	5, 633	1. 3
Roebuck clay	3, 676	. 8
Smelter-waste land	154	(1)
Stidham loamy fine sand, 0 to 2 percent slopes	3, 522	. 8
Strip Mines	1, 688	. 4
Taloka silt loam, 0 to 2 percent slopes	34, 890	7. 8
Vanoss loam, 0 to 1 percent slopes	369	. 1
Vanoss loam, 1 to 3 percent slopes	2, 220	. 5
Vanoss loam, 3 to 5 percent slopes	933	. 2
Verdigris silt loam	16, 529	3. 7
Verdigris-Pulaski soils, frequently flooded	19, 736	4. 4
Woodson silty clay loam, 0 to 1 percent slopes	3, 393	. 8
Wrightsville loam, thick surface	1, 065	. 2
Approximate land area	448, 000	100. 0

[1] Less than 0.05 percent.

The surface layer consists of about 24 inches of brown loam that is friable when moist and hard when dry. The subsoil, which is about 12 inches thick, consists of strong-brown light clay loam. This layer also is friable when moist and hard when dry. Sandstone commonly is at a depth of 38 inches.

Bates soils absorb water well and have moderate water-holding capacity. They are medium acid and moderately fertile. They are easy to work. Crops respond to fertilization and other management practices. These soils are used for cultivated crops, native grass pasture and hay, and bermudagrass pasture.

Following is a description of a typical profile of a Bates soil. This profile is in a native grass pasture 1,200 feet south and 50 feet west of the northeast corner of the NW¼ sec. 22, T. 11 N., R. 12 E.

A1—0 to 15 inches, brown (7.5YR 4/2) loam; dark brown (7.5YR 3/2) when moist; moderate, fine and medium, granular structure; friable when moist and hard when dry; porous; many roots and worm casts; pH 5.8; diffuse boundary.

A3—15 to 24 inches, brown (7.5YR 4/3) loam; dark brown (7.5YR 3/3) when moist; weak, fine and medium, granular structure; friable when moist and hard when dry; many root channels and worm casts; pH 5.8; diffuse boundary.

B2t—24 to 38 inches, strong-brown (7.5YR 5/6) light clay loam; strong brown (7.5YR 4/6) when moist; weak, fine, subangular blocky structure; friable when moist, slightly plastic when wet, and hard when dry; root channels and worm casts common; few fragments of yellowish-brown and yellowish-red sandstone; pH 5.8; clear boundary.

C—38 to 44 inches, fragments of yellowish-brown, brownish-yellow, and yellow sandstone, with 10 to 20 percent pale-brown (10YR 6/3) loam or sandy clay loam filling spaces between the fragments; pH 5.8.

R—44 inches +, yellowish-brown, brownish-yellow, and yellowish-red, fractured sandstone.

The texture of the A1 horizon ranges from loam to fine sandy loam. In places, there is no C horizon and the B2t horizon is directly over the R horizon. The depth to the C horizon ranges from 20 to 40 inches and is most commonly about 38 inches. The B2t horizon is faintly mottled in places.

Bates soils have less clay in the B2t horizon than Dennis soils. They are darker colored and less acid than Hartsells soils.

Bates loam, 1 to 3 percent slopes (BaB).—In some places this soil is reddish brown. Otherwise, the profile is similar to the one described for the Bates series.

This soil is moderately productive. The erosion hazard is moderate. (Capability unit IIe-1; Loamy Prairie range site)

Bates loam, 3 to 5 percent slopes (BaC).—This soil generally occurs on short foot slopes where runoff and colluvial sediments from the steeper areas above accumulate. It is darker colored and deeper over sandstone than is typical of the series.

Most of this soil is used for native grass pasture. If cultivated, it needs to be protected by diversion terraces. The erosion hazard is severe. (Capability unit IIIe-1; Loamy Prairie range site)

Bates-Collinsville fine sandy loams, 1 to 5 percent slopes (BcC).—This complex is 40 to 60 percent Bates fine

sandy loam, 30 to 50 percent Collinsville fine sandy loam, and 5 to 10 percent Bates loam. The Bates soil is 20 to 30 inches deep over sandstone, and the Collinsville soil 10 to 20 inches. For the Bates soil, this is shallower than is typical of the series. The water-holding capacity of this complex is limited because of the limited depth to bedrock.

Some of this complex has been cultivated, but now most of this acreage is either idle or is used for pasture. A small acreage has been planted to bermudagrass. (Capability unit IVe–1; Bates soil in Loamy Prairie range site, Collinsville soil in Shallow Prairie range site)

Breaks-Alluvial Land

Breaks-alluvial land complex (Bk) is 40 to 70 percent breaks and 30 to 60 percent alluvial land. It occurs as small drainageways, 100 to 500 feet in width but commonly about 200 feet. The slope range is 1 to 30 percent, but side slopes may be nearly vertical. The soil material ranges from fine sandy loam to clay loam in texture. A typical area of this complex consists of a shallow channel that is bordered by narrow bands of local alluvium and colluvium and has short, nearly vertical side slopes.

This complex is not suitable for cultivation. Almost all of it is in native grass, but in places there are trees, including elm, ash, and hackberry. Many of the smaller drainageways are good sites for ponds, and many ponds have been built in these areas. (Capability unit VIe–4; breaks in Loamy Prairie range site, alluvial land in Loamy Bottomland range site)

Broken Alluvial Land

Broken alluvial land (Bu) is made up of alluvial soils along the meandering channels of the smaller creeks. The slope range is 1 to 30 percent, but some channel cuts may be nearly vertical. The soil material ranges from fine sandy loam to clay loam in texture. Frequent floods deposit sediment in some areas and scour other areas. The floods are generally of short duration.

Broken alluvial land is not suitable for cultivation. Most of it is covered with a good stand of hardwoods. (Capability unit Vw–4; Loamy Bottomland range site)

Choteau Series

The Choteau series consists of deep, very gently sloping soils. These soils formed under grass, in a thin deposit of old loess or alluvium over silty shale.

The surface layer consists of about 16 inches of grayish-brown, friable loam, and the subsurface layer is pale brown and about 9 inches thick. The subsoil is mottled brownish-yellow clay loam. It is very hard when dry, but when it is moist, the upper part is friable and the lower part is very firm. Below a depth of 48 inches is mottled heavy clay loam.

Choteau soils absorb water moderately well and have good water-holding capacity. They are medium acid and moderately high in fertility. They are friable and easy to work. The response to fertilization and other management practices is good.

Following is a description of a typical profile of a Choteau soil. This profile is in a cultivated field 600 feet south and 500 feet east of the northwest corner of sec. 7, T. 14 N., R. 15 E.

A1—0 to 16 inches, grayish-brown (10YR 5/2) loam; very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, granular structure; friable; pH 6.0; clear boundary.

A2—16 to 25 inches, pale-brown (10YR 6/3) loam; dark yellowish brown (10YR 4/4) when moist; weak, medium, granular structure; friable; few small concretions; pH 5.5; gradual boundary.

B21t—25 to 36 inches, brownish-yellow (10YR 6/6) light clay loam; yellowish brown (10YR 5/6) when moist; faint mottles of light yellowish brown or pale brown; weak, medium, subangular blocky structure; friable when moist and very hard when dry; contains red and black concretions up to one-half inch in diameter that are soft when moist and hard when dry; pH 5.5; clear boundary.

B22t—36 to 48 inches, mottled brownish-yellow, yellowish-brown, pale-brown, and strong-brown clay loam; weak, coarse, subangular blocky structure; very firm when moist and very hard when dry; few fine concretions up to one-fourth inch in diameter; pH 7.0; gradual boundary.

B3—48 to 62 inches +, brownish-yellow (10YR 6/8) heavy clay loam; yellowish brown (10YR 5/8) when moist; mottles of yellowish brown and light grayish brown; massive; very firm when moist and very hard when dry; numerous, fine, black concretions; pH 8.0.

The A horizon is loam or very fine sandy loam 20 to 30 inches thick. In places the A2 horizon is faintly mottled with brownish yellow or yellowish brown. The thickness of the B21t horizon ranges from 6 to 12 inches.

Choteau soils have a thicker A horizon than Dennis soils. Their B2t horizon is less compact and clayey than that of Taloka soils.

Choteau loam, 1 to 3 percent slopes (ChB).—This soil has a profile similar to the one described for the Choteau series. It is on low, very gently sloping ridges and is associated with Taloka soils.

This is a productive soil. It is used for cultivated crops, bermudagrass pasture, and native grass meadow and pasture. (Capability unit IIe–1; Loamy Prairie range site)

Collinsville Series

The Collinsville series consists of very gently sloping to steep, loamy soils that are shallow over sandstone. There are many stony areas and outcrops of bedrock.

The surface layer consists of about 8 inches of dark grayish-brown, friable fine sandy loam. Beneath this there is commonly 3 or 4 inches of sandstone fragments mixed with fine sandy loam. The depth to hard sandstone ranges from 4 to as much as 20 inches but is ordinarily about 11 inches.

Collinsville soils have limited water-holding capacity. They are medium acid and moderately low in fertility. They are used principally as native grass pasture.

The Collinsville soils in this county are mapped only in complexes with Bates and Talihina soils.

Following is a description of a typical profile of a Collinsville soil. This profile is in a native grass pasture 300 feet west and 50 feet south of the northeast corner of sec. 36, T. 11 N., R. 12 E.

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; friable; contains fragments of yellowish-brown sandstone; pH 5.7; clear, irregular boundary.

C—8 to 11 inches, about 60 percent fragments of yellowish-brown sandstone and 40 percent dark grayish-brown (10YR 4/2) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; fine and medium, granular structure; friable; pH 5.7.

R—11 inches +, bedded sandstone with many cracks and fractures.

Depth to sandstone ranges from 4 to 20 inches and varies widely within short distances.

Collinsville soils are shallower than Bates soils, and they do not have a clay loam B2t horizon. They contain less clay than Talihina soils and developed in material weathered from sandstone rather than from clay and shale. They are darker colored than Hector soils.

Collinsville-Talihina complex, 10 to 30 percent slopes (CtE).—This complex is 60 to 70 percent Collinsville fine sandy loam and 30 to 40 percent Talihina clay. The soils are stony, and in places there are rock outcrops and ledges. Some areas are 5 to 10 percent Eram soils.

Almost the entire acreage is used as native grass pasture and range. (Capability unit VIIs–1; Shallow Prairie range site)

Dennis Series

The Dennis series consists of deep, very gently sloping or gently sloping soils on uplands. These soils formed under grass, in material weathered from silty shale or clay.

The surface layer consists of about 12 inches of grayish-brown silt loam that is friable when moist and slightly hard when dry. Below this is a 4-inch subsurface layer of brown heavy silt loam. This layer also is friable when moist and hard when dry. To a depth of about 36 inches, the subsoil is mottled light yellowish-brown to brownish-yellow clay loam, and below that it is mottled, very firm clay.

Dennis soils absorb water moderately well and have good water-holding capacity. They are medium acid and moderately high in fertility. They are easy to work. The response to fertilization and other management practices is good. These soils are used for cultivated crops, native grass pasture and hay, and bermudagrass pasture.

Following is a description of a typical profile of a Dennis soil. This profile is in a cultivated field 1,100 feet west and 50 feet north of the southeast corner of the SW¼ sec. 22, T. 15 N., R. 11 E.

A1—0 to 12 inches, grayish-brown (10YR 5/2) silt loam; very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; friable when moist and slightly hard when dry; pH 6.0; clear boundary.

A3—12 to 16 inches, brown (10YR 5/3) heavy silt loam; dark brown (10YR 3/3) when moist; few faint mottles of yellowish brown or brownish yellow; moderate, medium, granular structure; porous; friable when moist and hard when dry; pH 5.7; clear boundary.

B21t—16 to 24 inches, light yellowish-brown (10YR 6/4) clay loam; common, medium and fine mottles of brownish yellow and yellowish red; moderate, fine and medium, subangular blocky structure; firm when moist, plastic when wet, and hard when dry; few faint films on faces of peds; few, soft, black concretions; pH 5.7; clear boundary.

B22t—24 to 36 inches, brownish-yellow (10YR 6/8) heavy clay loam; mottles of yellowish brown (10YR 5/6); weak, coarse, subangular blocky structure; faint films on faces of peds; firm when moist, plastic when wet, and very hard when dry; contains nests or clumps of soft black concretions that are hard when dry; few roots and root channels; pH 5.7; gradual boundary.

B31—36 to 48 inches, coarsely mottled brownish-yellow (10YR 6/8), light brownish-gray (2.5Y 6/2), and yellowish-brown (10YR 5/6) light clay; massive; very firm when moist, plastic when wet, and extremely hard when dry; pH 7.5; diffuse boundary.

B32—48 to 88 inches +, yellowish-brown (10YR 5/6) light clay; dark yellowish brown (10YR 4/4) when moist; few to common, fine and medium mottles of light brownish gray (2.5Y 6/2); massive; very firm when moist, plastic when wet, and extremely hard when dry; few fine roots to a depth of about 6 feet; few fine concretions and fragments of sandstone and siltstone; pH 7.5.

The color of the A horizon is grayish brown, dark grayish brown, or brown. The depth to the B2t horizon ranges from 12 to 20 inches. The texture of the Bt horizon ranges from clay loam to light clay. The matrix color ranges from brownish yellow to dark yellowish brown, and the color of the mottles from reddish brown and yellowish brown to light brownish gray in the lower part.

Dennis soils are deeper than Bates soils and have more clay in the subsoil. They are lighter colored than Okemah soils and have less clay in the subsoil. They have a less compact and more clayey subsoil than Parsons soils.

Dennis silt loam, 1 to 3 percent slopes (DeB).—This soil has a profile similar to the one described for the Dennis series. It is suited to all kinds of crops grown in the county. Much of it is cultivated. (Capability unit IIe–2; Loamy Prairie range site)

Dennis silt loam, 3 to 5 percent slopes (DeC).—This soil is generally on colluvial foot slopes below areas of more sloping soils. These foot slopes receive runoff and colluvial sediments from higher areas. The surface layer is thicker than that in the profile described for the series. A few short slopes of as much as 6 percent were included with this soil in mapping.

If cultivated, this soil should be protected from overhead water. The hazard of erosion is high. (Capability unit IIIe–1; Loamy Prairie range site)

Dennis silt loam, 2 to 5 percent slopes, eroded (DeC2).—This soil is eroded to such an extent that in many places the surface layer is only 3 to 8 inches thick. Plowing mixes the subsoil material with the remaining surface soil. Shallow gullies have formed. Most of these can be filled by plowing, but they form again when it rains. (Capability unit IIIe–2; Loamy Prairie range site)

Dennis soils, 2 to 6 percent slopes, severely eroded (DsC3).—These soils have been affected severely by gully and sheet erosion. In some places gullies too deep to cross with farm machinery are only 50 to 200 feet apart, but the areas between the gullies are only moderately eroded. In other places there are only a few gullies, but the areas between are severely eroded. Areas of Parsons, Okemah, Bates, and other soils make up 5 to 10 percent of the acreage mapped.

Because of the serious hazard of erosion, these soils are not suitable for cultivation. (Capability unit VIe-1; Eroded Prairie range site)

Dougherty Series

The Dougherty series consists of deep soils on high terraces along the Deep Fork Canadian River. These soils formed in sandy alluvium, under oak forest and an understory of tall grasses. The slope range is 8 to 20 percent.

The surface layer consists of about 30 inches of loamy fine sand. This layer is grayish brown in the upper part and very pale brown in the lower part. The subsoil is reddish-yellow sandy clay loam and grades to reddish-yellow loamy fine sand at a depth of 4 or 5 feet.

The Dougherty soils absorb water readily, but they have excessive surface drainage and low water-holding capacity. They are medium acid or strongly acid and low in natural fertility. These soils are easy to work. The response to fertilization is good.

Little of the acreage has been cultivated, because of the moderately steep slopes and a serious hazard of gully erosion. Most of the acreage is used as range.

The Dougherty soils in this county are mapped only in a complex with Eufaula soils.

Following is a description of a typical profile of a Dougherty soil. This profile is 600 feet west and 50 feet north of the southeast corner of the SW¼ sec. 14, T. 14 N., R. 12 E.

A1—0 to 6 inches, grayish-brown (10YR 5/2) loamy fine sand; dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft when dry and very friable when moist; pH 6.0; clear boundary.

A2—6 to 30 inches, very pale brown (10YR 7/4) loamy fine sand; light yellowish brown (10YR 6/4) when moist; massive; soft when dry and very friable when moist; pH 5.8; clear boundary.

B2t—30 to 50 inches, reddish-yellow (5YR 6/6) sandy clay loam; yellowish red (5YR 5/6) when moist; weak, coarse, subangular blocky structure; clay films coating sand grains; friable when moist and very hard when dry; pH 5.5; diffuse boundary.

C—50 to 70 inches +, reddish-yellow (5YR 6/8) loamy fine sand; yellowish red (5YR 5/8) when moist; massive; friable when moist and slightly hard when dry; pH 5.5.

The color of the A1 horizon is grayish brown, brown, or pale brown, and that of the A2 horizon is pale brown or very pale brown. The depth to the B2t horizon ranges from 20 to 40 inches, and the texture of this horizon ranges from heavy fine sandy loam to sandy clay loam.

Dougherty soils have a thicker A horizon than Konawa soils. They have a redder B2t horizon than Stidham soils. Dougherty soils have better defined textural and color horizons than Eufaula soils.

Dougherty-Eufaula complex, rolling (Df).—This complex is 50 to 70 percent Dougherty loamy fine sand and 20 to 50 percent Eufaula fine sand. The Dougherty soil is on ridge slopes, and the Eufaula soil is on foot slopes and in valleys. The slope range is 8 to 20 percent.

Nearly the entire acreage is in the original oak woodland and is used for pasture. (Capability unit VIe-3; Deep Sand Savannah range site)

Dwight Series

The Dwight series consists of deep, nearly level soils. These soils formed under grass, in material weathered from shale.

The surface layer is grayish-brown silt loam 3 to 8 inches thick. The subsoil, to a depth of about 39 inches, is compact, impervious clay. The upper part of the subsoil is dark grayish brown, and the lower part is mottled grayish brown and yellowish brown. Below a depth of 2 feet, there are small clumps and fine seams of salt crystals. At a depth of 39 inches is yellowish-brown clay that contains a few small clumps of salt crystals.

Dwight soils have slow surface runoff and absorb water very slowly. They are droughty. The clay subsoil is difficult for plant roots to penetrate. Farming these soils is difficult, and crop yields are low. Most of the acreage is used for native grass pasture.

The Dwight soils in this county are mapped only in a complex with the Parsons soils.

Following is a description of a typical profile of a Dwight soil. This profile is 1,000 feet south and 100 feet east of the northwest corner of sec. 20, T. 12 N., R. 12 E.

A1—0 to 6 inches, grayish-brown (10YR 5/2) silt loam; dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; friable when moist and hard when dry; pH 6.0; abrupt, wavy boundary.

B21t—6 to 25 inches, dark grayish-brown (10YR 4/2) clay; very dark grayish brown (10YR 3/2) when moist; few to common, medium, yellowish-brown mottles that are distinct when moist but faint when dry; strong, coarse, blocky structure; very firm when moist and extremely hard when dry; thin, faint clay films are more common on horizontal faces than on vertical faces; many faces of vertical cracks have coatings of pale-brown very fine sandy loam; on horizontal faces these coatings are thinner and less common; pH 7.0; gradual boundary.

B22t—25 to 39 inches, variegated grayish-brown (10 YR 5/2) and yellowish-brown (10YR 5/8) clay; coarse blocky structure; very firm when moist and extremely hard when dry; light-gray very fine sandy loam coatings on faces of some peds, more common on vertical faces than on horizontal ones; small nests and fine seams of salt crystals are common; pH 8.0; gradual boundary.

B3—39 to 60 inches +, yellowish-brown (10YR 5/4) clay; dark yellowish brown (10YR 4/4) when moist; few, faint, medium mottles of light grayish brown; massive; extremely firm when moist and extremely hard when dry; a few nests or clumps of salt crystals that are coarser than the crystals in horizon B22t; few medium and small concretions; pH 8.5.

The A horizon ranges from 3 to 8 inches in thickness and from grayish brown to light gray in color. In places it is massive and strongly vesicular when dry. In bare or disturbed areas, a hard crust ½ to 1 inch thick forms as the surface dries. This crust has a platy structure and is highly vesicular. The B2t horizon has medium or coarse blocky structure. Clay films are distinct and continuous in some places but faint and discontinuous in other places.

Dwight soils have a thinner A horizon and a more compact B horizon than Parsons, Dennis, and Okemah soils. They are lighter colored and have a thinner, less clayey surface layer than Woodson soils.

Dwight-Parsons silt loams, 0 to 1 percent slopes (DwA).—This complex is 40 to 60 percent Dwight soils, 20 to 30 percent Parsons soils, and the rest Dennis and Okemah soils. Dwight and Parsons soils occur in alternating bands 50 to 200 feet across. The bands of Dwight soil are lower than the bands of Parsons and Dennis. The relief is wavy or undulating.

Most of the acreage is used for native grass pasture. (Capability unit IVs–1; Dwight soils in Shallow Claypan range site, Parsons soil in Claypan Prairie range site)

Eram Series

The Eram series consists of moderately deep, very gently sloping soils. They formed under grass, in material weathered from calcareous shale and clay.

The surface layer consists of about 10 inches of dark-gray clay loam that is friable when moist and sticky when wet and breaks into hard clods when dry. The subsoil, which is about 20 inches thick, is firm when moist, plastic when wet, and very hard when dry. The upper part of the subsoil is grayish brown, and the lower part is light olive brown. Below a depth of about 30 inches is grayish-brown, olive-yellow, and yellowish-brown, soft shale. This shale is calcareous or has thin seams or lenses that are calcareous.

Eram soils absorb water slowly and have limited water-holding capacity. They are moderately high in fertility. They are medium acid in the surface layer and slightly acid to mildly alkaline in the subsoil. They are more difficult to work than most soils in the county because of the slightly sticky surface layer. The response to fertilization and other management is moderate. These soils are used for cultivated crops and for native grass meadow and pasture.

The Eram soils in this county are mapped only in a complex with the Okemah soils.

Following is a description of a typical profile of an Eram soil. This profile is in a native grass pasture 800 feet north and 200 feet east of the southwest corner of sec. 3, T. 15 N., R. 12 E.

A1—0 to 10 inches, dark-gray (10YR 4/1) clay loam; very dark gray (10YR 3/1) when moist; strong, medium and coarse, granular structure; friable when moist and hard when dry; pH 6.0; gradual boundary.

B2t—10 to 20 inches, grayish-brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) when moist; weak, coarse, blocky structure; firm when moist, plastic when wet, and very hard when dry; few fragments of siltstone and sandstone; pH 6.5; gradual boundary.

B3—20 to 30 inches, light olive-brown (2.5Y 5/4) clay; olive brown (2.5Y 4/4) when moist; weak, coarse, blocky structure; very firm when moist, plastic when wet, and very hard when dry; few small fragments of siltstone and sandstone; few, fine, hard concretions of $CaCO_3$ in lower part; pH 7.5; gradual boundary.

C—30 to 40 inches +, grayish-brown, olive-yellow, brownish-yellow, and yellowish-brown, laminated shale with thin lenses of sandstone; soft when moist and hard when dry; calcareous seams are common.

The texture of the A horizon is clay loam or silty clay loam. The thickness of each horizon and of the solum varies considerably within short distances. The depth to the C horizon ranges from 26 to 40 inches but commonly is between 30 and 36 inches. The C horizon consists of shale or raw clay.

Eram soils are less deep than Okemah soils, and they have a less dark colored B horizon and lack an A3 horizon. They are less deep than Woodson soils and have a less compact B2t horizon. They are deeper than Talihina soils.

Eufaula Series

The Eufaula series consists of deep, nearly level to moderately steep, sandy soils on terraces a few feet above the flood plains of the Deep Fork Canadian River. These soils formed in sandy alluvium, under oak forest.

The surface layer consists of about 5 inches of grayish-brown fine sand, which grades to very pale brown fine sand that extends to a depth of 5 feet or more. The subsoil contains thin bands of reddish-yellow loamy fine sand.

Eufaula soils are medium acid or strongly acid and low in fertility. They are easy to work and need a minimum of tillage. These soils absorb water so rapidly that little or no water runs off. They have limited water-holding capacity, but the water held is readily available to plants. Most areas that have been cultivated are now idle.

Following is a description of a typical profile of an Eufaula soil. This profile is 400 feet north of the southeast corner of the NE¼ sec. 29, T. 13 N., R. 13 E.

Ap—0 to 5 inches, grayish-brown (10YR 5/2) fine sand; dark grayish brown (10 YR 4/2) when moist; single grain; loose; pH 6.0; clear boundary.

A2—5 to 45 inches, very pale brown (10 YR 8/4) fine sand; light yellowish brown (10 YR 6/4) when moist; single grain; loose; pH 5.5; gradual boundary.

B2t—45 to 75 inches +, very pale brown (10 YR 8/4) fine sand with bands of reddish-yellow loamy fine sand; very pale brown (10YR 7/4) when moist; bands are ¼ to 1 inch thick and total about 8 inches; massive; loose; pH 5.5.

The upper part of the A horizon ranges from grayish brown to brown or pale brown. The bands in the B2t horizon range from loamy fine sand to light sandy clay loam in texture and from ⅛ inch to more than 3 inches in thickness.

Eufaula soils are coarser textured in both the surface layer and the subsoil than Konawa, Dougherty, and Stidham soils.

Eufaula fine sand, undulating (EuB).—This soil (fig. 6) has a profile similar to the one described for the Eufaula series. The slope range is 0 to 3 percent. Water erosion is not a problem, but cultivated areas that are bare late in winter and early in spring are susceptible to wind erosion. (Capability unit IVs–2; Deep Sand Savannah range site)

Hartsells Series

The Hartsells series consists of moderately deep, very gently sloping or gently sloping soils that formed under forest in material weathered from coarse-grained sandstone.

The surface layer consists of about 12 inches of fine sandy loam that is pale brown in the upper part and

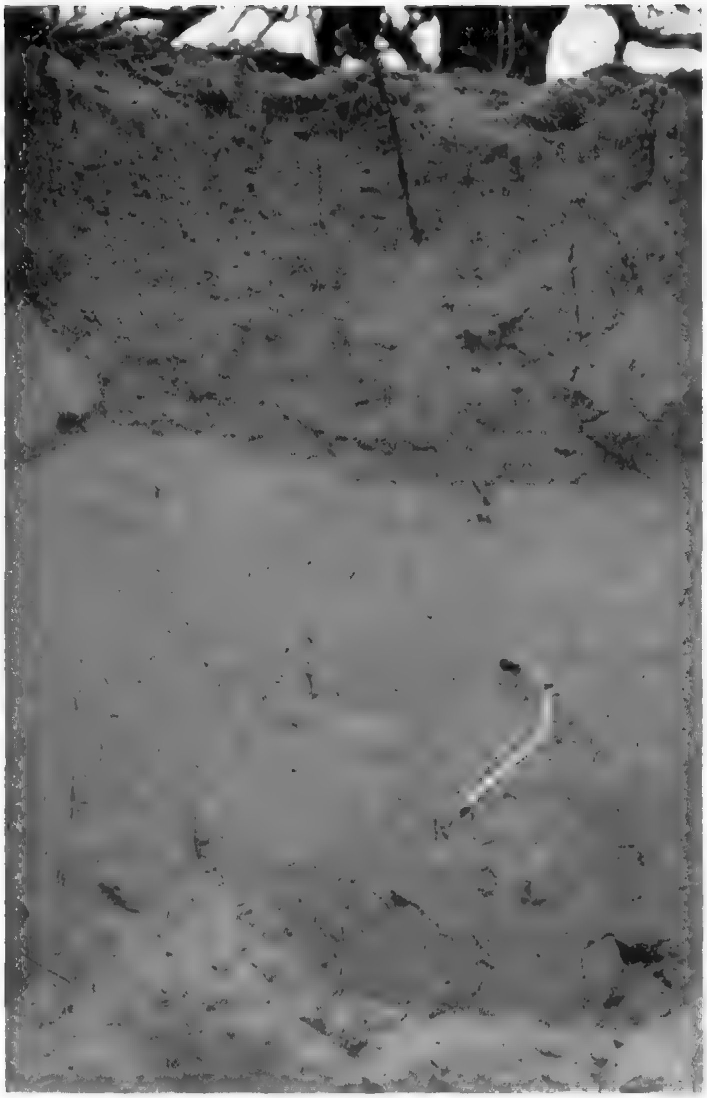

***Figure 6.*—Profile of Eufaula fine sand, undulating.**

very pale brown in the lower part. The subsoil, which is about 20 inches thick, consists of mottled, brownish-yellow sandy clay loam.

Hartsells soils have moderate water-holding capacity. They are medium acid to very strongly acid and low in fertility. They are easy to work. The response to fertilization and other management is moderate. These soils are used for cultivated crops, bermudagrass pasture, and native grass pasture and range.

Following is a description of a typical profile of a Hartsells soil. This profile is in an abandoned field, 500 feet south of the northeast corner of the NW¼ sec. 25, T. 15 N., R. 12 E.

A1—0 to 5 inches, pale-brown (10YR 6/3) fine sandy loam; brown (10YR 4/3) when moist; weak, fine, granular structure; very friable; pH 6.0; clear boundary.

A2—5 to 12 inches, very pale brown (10YR 7/4) fine sandy loam; yellowish brown (10YR 5/4) when moist; massive; porous and very friable; pH 5.5; clear boundary.

B21t—12 to 20 inches, brownish-yellow (10YR 6/6) light sandy clay loam; yellowish brown (10YR 5/6) when moist; weak, medium, subangular blocky structure; firm when moist, plastic when wet, and very hard when dry; few fine mottles of yellowish red (5YR 5/8) in lower part; pH 5.0; gradual boundary.

B22t—20 to 32 inches, mottled pale-brown (10YR 6/3), brownish-yellow (10YR 6/6), yellowish-brown (10YR 5/8), and red (2.5YR 4/8) sandy clay loam; massive to weak, medium, subangular blocky structure; firm when moist, plastic when wet, and very hard when dry; pH 5.0.

R—32 inches +, acid sandstone; weakly indurated and easily broken and crushed when moist, but hard when dry.

The depth to sandstone ranges from 24 to 40 inches but is commonly between 30 and 36 inches.

Hartsells soils are associated with Hector soils, but they are deeper and have a B2t horizon. They are lighter colored and more acid than Bates soils.

Hartsells fine sandy loam, 1 to 3 percent slopes (HaB).—This soil has a profile similar to the one described for the Hartsells series. Included in mapping were some areas that have a reddish-yellow B21t horizon rather than a brownish-yellow one.

Most of the acreage has been cultivated, but now many areas are idle or are used for pasture. The erosion hazard is moderate. (Capability unit IIe-3; Sandy Savannah range site)

Hector Series

The Hector series consists of shallow, very gently sloping to steep soils. These soils formed in material weathered from coarse-grained sandstone under forests of blackjack oak and post oak.

The surface layer consists of about 6 inches of grayish-brown stony sandy loam. The subsoil, which is about 5 inches thick, consists of light yellowish-brown fine sandy loam and has fragments of sandstone in the lower part. The depth to sandstone ranges from 5 to 20 inches but is commonly about 13 inches.

Hector soils have excessive surface drainage and limited water-holding capacity. They are acid and low in fertility. Nearly the entire acreage is forested with blackjack oak and post oak and is used for pasture.

The Hector soils in this county are mapped only in complexes with Hartsells and other soils.

Following is a description of a typical profile of a Hector soil. This profile is in a forest of blackjack oak and post oak, 700 feet north of the southwest corner of sec. 36, T. 15 N., R. 11 E.

A1—0 to 6 inches, grayish-brown (10YR 5/2) stony sandy loam; dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; very friable; pH 5.5; clear boundary.

B—6 to 13 inches, light yellowish-brown (10YR 6/4) fine sandy loam; dark yellowish brown (10YR 4/6) when moist; massive; very friable; fragments of soft, coarse-grained sandstone in lower part; pH 6.0.

R—13 to 15 inches +, yellowish-brown, acid sandstone.

In places these soils have a stone-free surface, but in other places, as much as 40 percent of the surface is covered with stones. The depth to sandstone ranges from 5 to 20 inches, and the sandstone ranges from 6 inches to more than 6 feet in thickness. In places where the sandstone is thin, it is interbedded with layers of clay.

Hector soils are lighter colored and more acid than Collinsville soils and are covered with oak forest rather than grass. They are shallower and stonier than Hartsells soils, and their profile is less well developed.

Hector-Hartsells fine sandy loams, 1 to 5 percent slopes (HhC).—The complex is 40 to 60 percent Hector soil and the rest Hartsells soil. Hector soil has a profile similar to the one described as typical of Hector soil, but it has a surface layer of fine sandy loam and is not stony. Hartsells fine sandy loam is described under "Hartsells Series." In places, there are rock outcrops and some surface stones, but the surface is mostly free of stones. Some of this soil has been cultivated, but most of it is now idle or used for grazing. (Capability unit IVe–2; Hector soil in Shallow Savannah range site, Hartsells soil in Sandy Savannah range site)

Hector complex, 5 to 30 percent slopes (HtE).—This complex is 50 to 75 percent Hector stony sandy loam (fig. 7) and 20 to 45 percent similar soils that have a subsoil of red to yellowish-brown and light olive-brown clay. These soils are too stony and rocky to be cultivated and are used as wooded range. (Capability unit VIIs–2; Shallow Savannah range site)

Konawa Series

The Konawa series consists of deep soils on high terraces along the Deep Fork Canadian River. These soils formed in sandy alluvium under oak forest. The slope range is 3 to 8 percent.

The surface layer consists of about 16 inches of loamy fine sand. It is light yellowish brown in the upper part and pink in the lower part. The subsoil is red sandy clay loam that grades to light-red fine sandy loam at a depth of 4 or 5 feet.

Konawa soils absorb water readily but have excessive surface drainage and moderate water-holding capacity. They are medium acid to very strongly acid and low in natural fertility. They are easy to work. The response to fertilization is good.

A considerable acreage of these soils has been cultivated, but now most of this is idle or is used for pasture. The rest remains in oak forest and is used for pasture. More than a third of the acreage is severely gullied.

Following is a description of a typical profile of a Konawa soil. This profile is in an abandoned field near the southeast corner of the SW¼ sec. 13, T. 13 N., R. 12 E.

A1—0 to 8 inches, light yellowish-brown (10YR 6/4) loamy fine sand; dark yellowish brown (10YR 4/4) when moist; weak, fine, granular structure; very friable when moist and loose when dry; pH 6.0; clear boundary.

A2—8 to 16 inches, pink (7.5YR 7/4) loamy fine sand; strong brown (7.5YR 5/6) when moist; very friable when moist and loose when dry; pH 6.0; clear boundary.

B21t—16 to 28 inches, red (2.5YR 5/8) sandy clay loam; red (2.5YR 4/8) when moist; moderate, medium, subangular blocky structure; firm when moist and very hard when dry; pH 5.0; gradual boundary.

B22t—28 to 40 inches, red (2.5YR 5/8) sandy clay loam; red (2.5YR 4/8) when moist; weak, coarse, subangular blocky structure; firm when moist and very hard when dry; pH 5.5; diffuse boundary.

B3—40 to 58 inches, red (2.5YR 5/8) sandy clay loam; red (2.5YR 4/8) when moist; massive; firm when moist and hard when dry; pH 5.5; diffuse boundary.

C—58 to 70 inches +, light-red (2.5YR 6/8) fine sandy loam; red (2.5YR 5/8) when moist; massive; friable; pH 5.5.

The A horizon ranges from 12 to 20 inches in thickness. The B2 horizon is clay loam or sandy clay loam. The color of the layers below the A2 horizon is 2.5YR or 5YR in hue.

Konawa soils are more sloping than Stidham soils and have a red subsoil rather than a brownish yellow one. They are finer textured throughout than Eufaula soils and have better defined horizons. Konawa soils have a thinner A horizon than Dougherty soils and a coarser textured A horizon than Hartsells soils.

Konawa loamy fine sand, 3 to 8 percent slopes (KsD).—This soil has a profile similar to the one described for the Konawa series. It is highly susceptible to gully erosion. (Capability unit IVe–3; Deep Sand Savannah range site)

Konawa loamy fine sand, 3 to 8 percent slopes, severely eroded (KsD3).—This soil is severely gullied. The

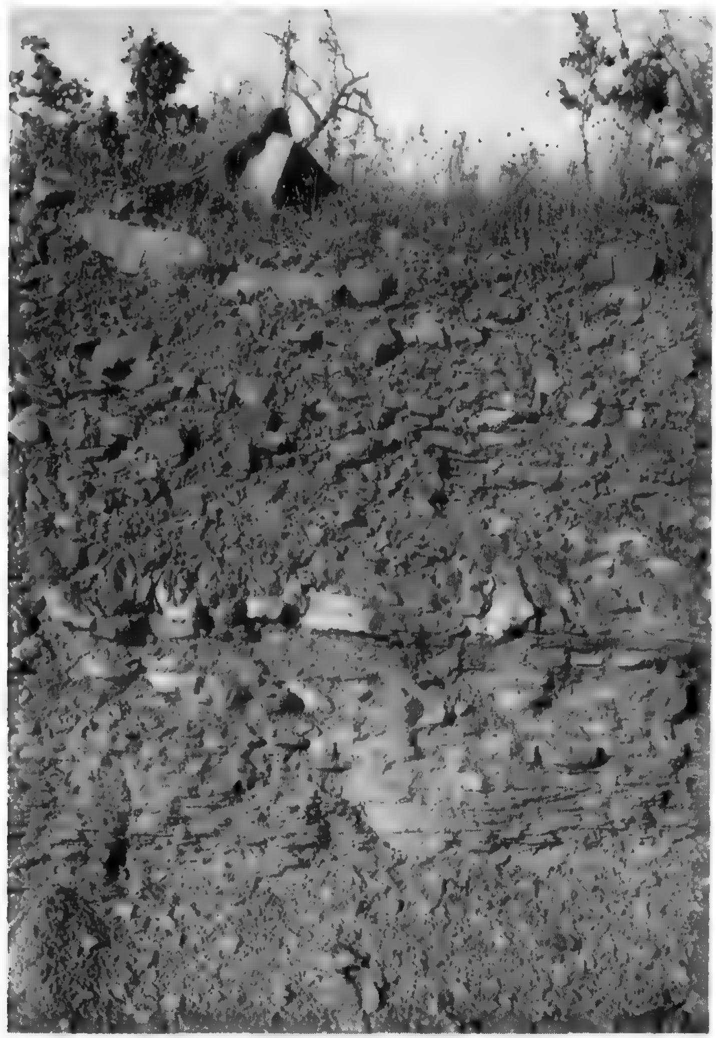

Figure 7.—Profile of Hector stony sandy loam in road cut.

gullies are 25 to 200 feet apart, 2 to 12 feet deep, and 10 to 50 feet wide. Between the gullies the profile is similar to the one described for the Konawa series, but sheet erosion has thinned the surface layer in some places. This soil is not suitable for cultivation. (Capability unit VIe–2; Deep Sand Savannah range site)

Lightning Series

The Lightning series consists of deep, somewhat poorly drained, level or slightly depressed soils on bottom lands. They are flooded occasionally but usually for not longer than a few hours at a time.

The surface layer consists of about 11 inches of friable, gray silt loam. The subsurface layer, which is about 9 inches thick, consists of gray silty clay loam that is friable when moist and very hard when dry. At a depth of about 20 inches is gray clay that is mottled with light gray and is firm when moist and very hard when dry. The depth to dark-gray clay is about 3 feet.

Lightning soils absorb water slowly. Surface runoff is slow, and in wet weather water stands in low places. These soils are strongly acid to moderately alkaline and moderately high in fertility. Many areas that have been cultivated are now pasture. Some of the better drained areas are still cultivated.

Following is a description of a typical profile of a Lightning soil. This profile is in an old field that has grown up to weeds, 500 feet south of the northwest corner of the NE¼ sec. 30, T. 14 N., R. 13 E.

A1 0 to 11 inches, gray (10YR 5/1) heavy silt loam; dark gray (10YR 4/1) when moist; moderate, fine, granular structure; friable when moist and hard when dry; pH 5.5; clear boundary.

B1—11 to 20 inches, gray (10YR 5/1) silty clay loam; dark gray (10YR 4/1) when moist; few, fine, faint mottles of light gray; massive; few pores and root channels; friable when moist, somewhat plastic when wet, and very hard when dry; pH 6.0; gradual boundary.

B21t—20 to 36 inches, gray (10YR 5/1) clay; dark gray (10YR 4/1) when moist; distinct, medium mottles of light gray; thin coating of light gray on faces of cracks; massive; firm when moist, plastic when wet, and very hard when dry; few pores and root channels; pH 6.5; gradual boundary.

B22t—36 to 60 inches +, dark-gray (10YR 4/1) clay; very dark gray (10YR 3/1) when moist; thin streaks of light gray along cracks and old root channels; massive; firm when moist, plastic when wet, and very hard when dry; pH 8.0.

The texture of the A1 horizon ranges from loam to silty clay loam but is commonly silt loam. Mottling begins at the surface in some places and at a depth of 20 to 30 inches in other places. The colors commonly have a chroma of 1 and in no place a chroma of more than 2. Slickspots are common in places.

Lightning soils are less well drained than Verdigris soils, and they have a finer textured subsoil. They are better drained than Roebuck soils, and they have a coarser textured surface layer.

Lightning silt loam (Lg).—This soil has a profile similar to the one described for the Lightning series. It is on bottom lands and is occasionally flooded, usually for not longer than a few hours. The slope range is 0 to 1 percent.

Most of this soil is used for pasture, but a few of the better drained areas are cultivated. Pecans are harvested in some areas. Somewhat poor drainage limits the choice of crops. (Capability unit IIIw–1; Heavy Bottomland range site)

Mason Series

The Mason series consists of deep, nearly level soils that are on low terraces 5 to 30 feet above the flood plains of the larger creeks. These soils formed in old alluvium.

The surface layer consists of about 15 inches of friable grayish-brown loam. The upper part of the subsoil consists of brown, friable heavy loam over mottled, firm clay loam. Below a depth of 40 inches is light-gray clay loam mottled with yellowish brown. This material is firm and compact when moist and very hard when dry.

Mason soils absorb water moderately well and have good water-holding capacity. They are medium acid or strongly acid and moderately high in fertility. They are easy to work. The response to fertilization and other management is good. These soils are used for cultivated crops, bermudagrass pasture, and native grass pasture.

Following is a description of a typical profile of a Mason soil. This profile is in an area of tall grasses and scattered deciduous trees, 100 feet east and 100 feet south of the northwest corner of sec. 7, T. 15 N., R. 14 E.

A1 0 to 15 inches, grayish-brown (10YR 5/2) loam; very dark grayish brown (10YR 3/2) when moist; strong, medium and fine, granular structure; friable; pH 6.0; clear boundary.

B21t—15 to 28 inches, brown (10YR 5/3) heavy loam; dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; friable when moist and hard when dry; pH 5.5; clear boundary.

B22t—28 to 40 inches, mottled yellowish-brown (10YR 5/4), grayish-brown (10YR 5/2), brownish-yellow (10YR 6/8), and yellowish-red (5YR 5/8) clay loam; weak, coarse, subangular blocky structure; firm when moist and very hard when dry; few concretions 2 to 5 millimeters in diameter; pH 5.5; clear boundary.

B3—40 to 64 inches +, light-gray (10YR 7/2) clay loam mottled with yellowish brown (10YR 5/8); grayish brown (10YR 5/2) mottled with yellowish brown (10YR 5/6) when moist; massive; firm and compact when moist and very hard when dry; few black concretions 5 to 10 millimeters in diameter; pH 5.5.

The texture of the A horizon is fine sandy loam in places, instead of loam. The B21t horizon is 6 to 14 inches thick. In places it has a few, fine, faint mottles of yellowish red in the lower part.

Mason soils are on higher terraces than Verdigris soils and on lower terraces than Vanoss soils. Their horizons are better defined texturally and structurally than those of Verdigris soils.

Mason loam (0 to 1 percent slopes) (Ms).—This soil has a profile similar to the one described for the Mason series. It is associated with Verdigris soils, which are on slightly lower terraces and are flooded occasionally. (Capability unit I–1; Loamy Bottomland range site)

Ochlockonee Series

The Ochlockonee series consists of deep soils on bottom lands along the Deep Fork Canadian River. These soils

are on the outer edges of the flood plains and are seldom flooded. The Ochlockonee soils mapped in this county are not typical of the series.

These soils are generally fine sandy loam throughout the profile, but in places they consist of stratified loamy fine sand and loam or clay loam. They become lighter colored and more mottled with increasing depth.

Ochlockonee soils are medium acid or strongly acid and moderately fertile. They are wet most of the time.

Ochlockonee soils in this county are too wet for most crops but are well suited to bermudagrass. Nearly all the acreage has been cultivated but is now in bermudagrass or low-quality broomsedge bluestem.

Following is a description of a typical profile of an Ochlockonee soil, wet, as mapped in this county. This profile is 50 feet south of the northeast corner of the NW1/4 sec. 36, T. 14 N., R. 12 E.

A1—0 to 11 inches, grayish-brown (10YR 5/2) fine sandy loam; very dark grayish brown (10 YR 3/2) when moist; few, fine, faint mottles of yellowish brown and dark reddish brown; weak, fine, granular structure; friable; pH 6.0; clear boundary.

AC—11 to 26 inches, brown (10YR 5/3) fine sandy loam; brown (10YR 4/3) when moist; faint mottles of yellowish brown; massive; few tubular pores or root channels; friable; pH 5.5; gradual boundary.

C1—26 to 43 inches, very pale brown (10 YR 7/4) fine sandy loam; light yellowish brown (10 YR 6/4) when moist; common, medium mottles of strong brown, yellowish brown, and brownish yellow; massive; numerous, fine, tubular pores; few black concretions; pH 5.0; clear boundary.

C2—43 to 65 inches +, coarsely mottled white, reddish-yellow, and yellowish-red fine sandy loam; massive; friable; pH 5.0.

The texture ranges from fine sandy loam to loamy fine sand, and there is some stratification with thin layers of loam or clay loam.

Ochlockonee soils are more mottled than Pulaski, Lightning, Roebuck, and Verdigris soils. They are coarser textured than Lightning, Roebuck, and Verdigris soils.

Ochlockonee soils, wet (0 to 1 percent) (Oc).—These soils have a profile similar to the one described for the Ochlockonee series. They are wetter than typical Ochlockonee soils. The depth to the water table ranges to more than 30 inches, depending on the season and the place. They are generally on slightly higher parts of the bottom lands than Lightning, Verdigris, and Roebuck soils. Nearly all the acreage is used for bermudagrass pasture or hay. (Capability unit Vw–1; Subirrigated range site)

Oil-Waste Land

Oil-Waste land (Od) consists of areas that have been seriously damaged by salt water (fig. 8) or by oil, or by a combination of oil and salt water. The slope range is predominantly 1 to 5 percent but ranges to as much as 30 percent. Salt water kills the vegetation and disperses the soil; consequently, all of this land type is eroded.

Areas of Oil-Waste land are generally small. They support little vegetation and cannot be used for crops or as range. (Capability unit VIIIs–1; not placed in a range site)

Figure 8.—Oil-Waste land damaged by salt water.

Okemah Series

The Okemah series consists of deep, nearly level or very gently sloping, dark-gray soils. These soils formed under grass, in material weathered from calcareous shale and clay with thin lenses of limestone in places.

The surface layer is 12 inches thick. It consists of dark-gray silt loam or clay loam that is friable when moist and slightly hard when dry. Below this is a 9-inch subsurface layer of dark-gray silty clay loam or silty clay that has a few, faint mottles of yellowish brown. The subsoil consists of mottled clay that is very firm when moist and very hard when dry. In places there are thin lenses of limestone or fragments of limestone.

The Okemah soils are moderately high in fertility. They are medium acid in the surface layer and neutral in the subsoil. These soils absorb water slowly. They have a high water-holding capacity, and the moisture held is readily available to plants. The response to fertilization and other management is good. These soils are used for cultivated crops and for native grass meadow.

Following is a description of a typical profile of an Okemah soil. This profile is in a native grass meadow, 1,350 feet south and 100 feet west of the northeast corner of sec. 31, T. 15 N., R. 11 E.

A1—0 to 12 inches, dark-gray (10YR 4/1) silt loam; very dark brown (10YR 2/2) when moist; strong, medium, granular structure; friable when moist and slightly hard when dry; pH 6.0; clear, wavy boundary.

A3—12 to 21 inches, dark-gray (10YR 4/1) silty clay loam; few, fine, faint mottles of grayish-brown and yellowish-brown; strong, medium and coarse, granular structure; firm when moist and hard when dry; pH 6.0; clear, wavy boundary.

B21t—21 to 29 inches, mottled dark-gray (10 YR 4/1), yellowish-brown (10YR 5/4), reddish-brown (5YR 5/4), and light olive-brown (2.5Y 5/4) clay; weak, medium, blocky structure; very firm when moist and very hard when dry; few fine iron concretions; pH 6.5; gradual boundary.

B22t—29 to 43 inches, mottled gray (10YR 5/1), light olive-brown (2.5Y 5/4), light brownish-gray (10YR 6/2), reddish-brown (2.5YR 4/4), dark grayish-brown

(2.5Y 4/2), and light yellowish-brown (10YR 6/4) clay; weak, coarse, blocky structure; very firm when moist and very hard when dry; few iron concretions; pH 7.0; gradual boundary.

B3—43 to 62 inches +, coarsely mottled very dark grayish-brown (2.5Y 3/2), light olive-brown (2.5Y 5/4), light yellowish-brown (10YR 6/4), reddish-brown (2.5YR 4/4), and dark-gray (5Y 4/1) clay; dark grayish brown (2.5Y 4/2) when moist and crushed; massive; very firm; pH 8.0.

The texture of the A horizon ranges from silt loam to light silty clay loam. The depth to the B2t horizon ranges from 16 to 24 inches. In places, the B horizon is dark gray (10YR 4/1) to grayish brown (10YR 5/2) and the mottling is less pronounced than in the profile described.

Okemah soils are darker, grayer, finer textured, and less acid than Dennis soils. They have less clay in the A1 horizon and a more gradual transition to the B2t horizon than Woodson soils. Okemah soils have thicker horizons than Eram soils.

Okemah silt loam, 0 to 1 percent slopes (OkA).—This soil has a profile similar to the one described for the Okemah series, but the subsoil is slightly darker colored and less mottled. Runoff is slow. Woodson silty clay loam makes up 5 to 15 percent of the acreage mapped.

A large part of this soil is cultivated. Yields of most crops are good. (Capability unit I–2; Loamy Prairie range site)

Okemah silt loam, 1 to 3 percent slopes (OkB).—This soil has a profile similar to the one described for the Okemah series. The erosion hazard is moderate.

Much of this soil is cultivated. Yields of most crops are good. (Capability unit IIe–2; Loamy Prairie range site)

Okemah-Eram clay loams, 1 to 3 percent slopes (OrB).—This complex is 40 to 60 percent Okemah clay loam and 30 to 50 percent Eram clay loam. These soils are higher than other Okemah soils. Okemah silt loam makes up 5 to 10 percent of the acreage mapped.

These soils are either cultivated or used for native grass pasture and meadow. They are more difficult to work than other Okemah soils in the county. (Capability unit IIIe–5; Loamy Prairie range site)

Parsons Series

The Parsons series consists of deep, nearly level or very gently sloping soils. These soils formed under grass in material weathered from silty shale or in deposits of old loess or alluvium over shale.

The surface layer consists of about 8 inches of grayish-brown silt loam. Below this is a 4-inch subsurface layer of light brownish-gray silt loam mottled with yellowish brown. The subsoil consists of mottled pale-brown, light olive brown, or grayish-brown, dense clay that is very firm and compact when moist and very hard when dry. The mottling is more distinct in the lower part of the subsoil.

Parsons soils are moderately fertile and medium acid. They are easy to work. In wet weather, these soils have a temporary water table above the clay subsoil. They absorb water slowly. The water-holding capacity is good, but the moisture held is not readily available to plants because of the heavy subsoil, which is also difficult for roots to penetrate. Crops that mature early in the season, before dry weather begins, respond best to fertilizer and other management. These soils are used for cultivated crops, bermudagrass pasture, and native grass pasture and meadow.

Following is a description of a typical profile of a Parsons soil. This profile is in a cultivated field, 1,000 feet north and 300 feet west of the southeast corner of the SW¼ sec. 1, T. 15 N., R. 11 E.

A1—0 to 8 inches, grayish-brown (10YR 5/2) silt loam; very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; friable; pH 6.0; clear boundary.

A2—8 to 12 inches, light brownish-gray (10YR 6/2) silt loam; dark grayish brown (10YR 4/2) when moist; few, fine, faint mottles of yellowish brown in lower part; weak, fine and medium, granular structure grading to massive in lower part; porous; friable when moist and hard when dry; pH 6.0; abrupt, wavy boundary.

B21t—12 to 24 inches, pale-brown (10YR 6/3) clay; grayish brown (10YR 5/2) when moist; common, medium mottles of grayish brown, brownish yellow, and yellowish brown; moderate, coarse, blocky structure; very firm when moist and very hard when dry; thin, discontinuous clay films on sides of peds; few fine concretions; pH 6.5; gradual boundary.

B22t—24 to 36 inches, light olive-brown (2.5Y 5/4) clay; olive brown (2.5Y 4/4) when moist; faint mottles of brownish yellow (10YR 6/8); weak, medium and coarse, blocky structure; compact; very firm when moist and extremely hard when dry; faint, discontinuous clay films on faces of peds; few fine concretions; pH 7.5; gradual boundary.

B3—36 to 62 inches +, diffusely mottled brownish-yellow (10YR 6/8), light brownish-gray (10YR 6/2), light-gray (10YR 7/2), reddish-yellow (7.5YR 6/8), and strong-brown (7.5YR 5/8) clay; massive; compact and very firm when moist and extremely hard when dry; few, fine, black concretions; pH 8.0.

The depth to the B2t horizon ranges from 8 to 16 inches but is commonly about 12 inches. Soft shale or siltstone occurs at a depth of 5 or 6 feet in places.

Parsons soils have a more abrupt boundary between the surface layer and the subsoil than Dennis soils have, and they have a more clayey and compact subsoil. They have a thicker surface layer than Dwight soils and a thinner one than Taloka soils. Parsons soils are lighter colored than Woodson soils and have a less clayey surface layer.

Parsons silt loam, 0 to 1 percent slopes (PaA).—This soil (fig. 9) has a profile similar to the one described for the Parsons series. Runoff is slow. Most of this soil is used for cultivated crops or native grass pasture or meadow, but some of it has been planted to bermudagrass. The major limitation is the impervious subsoil. (Capability unit IIs–1; Claypan Prairie range site)

Parsons silt loam, 1 to 3 percent slopes (PaB).—The surface layer of this soil is slightly thinner than that in the profile described. Surface drainage is good. In places as much as 25 percent of the surface layer has been removed by erosion, and there are a few, small, shallow gullies. The erosion hazard is moderately severe.

This soil is used for cultivated crops or for native grass pasture and meadow. (Capability unit IIIe–3; Claypan Prairie range site)

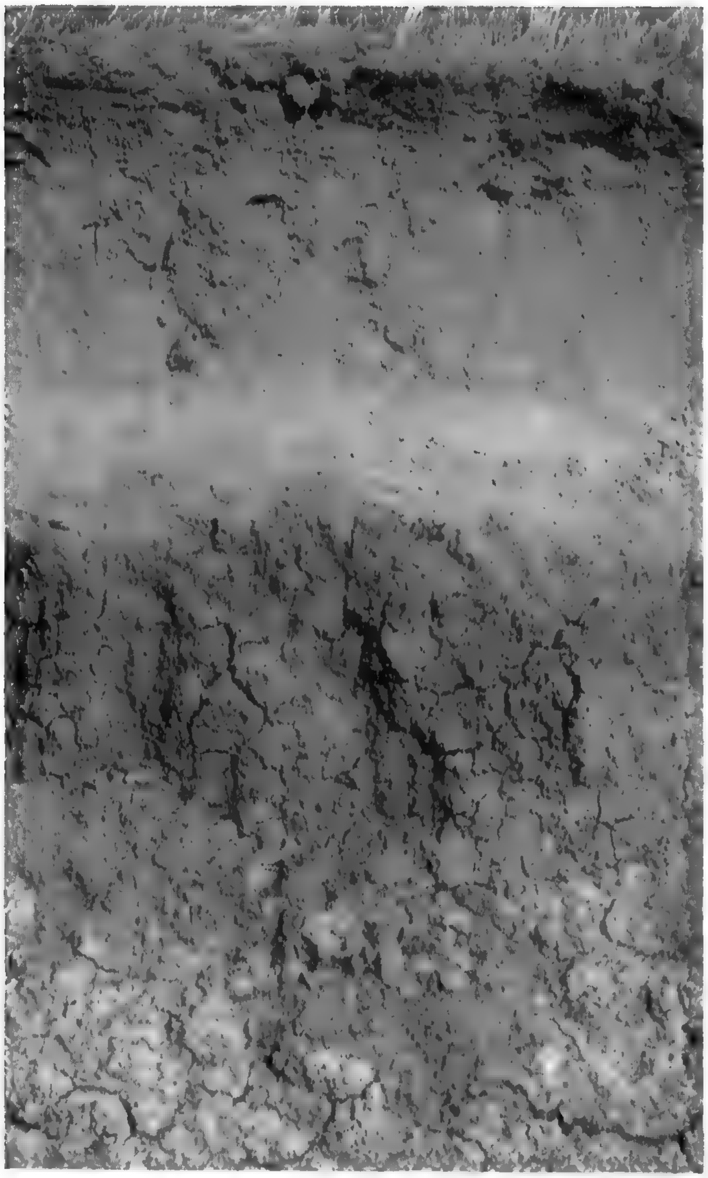

Figure 9.—Profile of Parsons silt loam, 0 to 1 percent slopes.

Pulaski Series

The Pulaski series consists of deep soils on bottom lands along the Deep Fork Canadian River. These soils developed in fine sandy loam sediments under hardwood forest. They are flooded several times in most years, sometimes for several days at a time.

These soils generally consist of fine sandy loam throughout the profile. In places there is a recent deposit of fine sand, 4 to 6 inches thick, on the surface. In some places the soil is stratified with loamy fine sand, loam, or clay loam.

Pulaski soils are medium acid or slightly acid and moderately fertile. They hold a moderate amount of water, and the water held is readily available to plants. These soils are easy to work. They are used for bermudagrass pasture and pecan trees.

The Pulaski soils in this county are mapped only in a complex with Verdigris soils. The complex is described under the heading "Verdigris Series."

Following is a description of a typical profile of a Pulaski soil. This profile is in a bermudagrass pasture that has some willows and other trees. It is 1,100 feet north and 1,600 feet west of the southeast corner of sec. 22, T. 13 N., R. 12 E.

A1—0 to 11 inches, brown (7.5YR 5/4) fine sandy loam; brown (7.5YR 4/4) when moist; few, fine, faint mottles of reddish brown (5 YR 4/4) and yellowish red (5YR 5/8); weak, medium, granular structure; friable; pH 6.0; gradual boundary.

C—11 to 60 inches +, brown (7.5YR 5/4) fine sandy loam; faint mottles of dark brown (7.5YR 4/4) and brown (10YR 5/3); strong brown (7.5YR 4/6) when crushed and moist; massive; friable; pH 6.0.

In places the uppermost 4 to 6 inches of the surface layer consists of recently deposited pale-brown fine sand. In many places there are 6- to 12-inch layers of loamy fine sand, loam, or clay loam. The pH is 6.0 to 6.5.

Pulaski soils are coarser textured than Verdigris, Lightning, and Roebuck soils. They are browner than Lightning soils and less red than Roebuck soils.

Roebuck Series

The Roebuck series consists of deep, poorly drained soils on flood plains along the Deep Fork Canadian River. These soils developed in clay sediments. They are flooded several times a year, sometimes for several days.

Both the surface layer and the subsoil, to a depth of about 60 inches, consist of reddish-brown clay mottled with yellowish red. The 9-inch surface layer is crumbly and friable when moist and plastic and sticky when wet. The material below a depth of 9 inches is firm when moist, plastic when wet, and very hard when dry.

Roebuck soils are slightly acid to moderately alkaline and moderately high in fertility. They are hard to work. Water is absorbed very slowly. Runoff is slow, and water stands in low places.

Following is a description of a typical profile of a Roebuck soil. This profile is in a timbered area. It is 200 feet south and 100 feet west of the northeast corner of sec. 11, T. 13 N., R. 12 E.

A—0 to 9 inches, reddish-brown (5YR 4/4) clay; dark reddish brown (5YR 3/3) when moist; common, fine, distinct mottles of yellowish red; strong, medium and coarse, granular structure; crumbly and friable when moist and plastic when wet; pH 6.5; gradual boundary.

C—9 to 60 inches +, reddish-brown (5YR 4/4) clay; dark reddish brown (5YR 3/3) when moist; many, fine, distinct mottles of yellowish red; weak, coarse, blocky structure in upper part, grading to massive in lower part; firm when moist, plastic when wet, and very hard when dry; pH 6.5.

Colors range from 7.5YR to 2.5YR in hue and from 2 to 3 in both chroma and value. In places there are some mottles of dark gray below a depth of 30 inches. The pH of the A horizon is generally 6.0 to 6.5, and that of the C horizon 6.5 to 8.0.

Roebuck soils are finer textured and less well drained than Lightning, Pulaski, and Verdigris soils.

Roebuck clay (0 to 1 percent slopes) (Rc).—This soil is frequently flooded for periods of several days, and water stands in low places for long periods. More than half of the acreage has a profile similar to that described for the Roebuck series. About 40 percent has a surface layer of dark grayish brown that grades to dark gray at a depth of about 36 inches.

This soil is not suited to cultivation. It is used as wooded pasture. There are a few native pecan trees. (Capability unit Vw–2; Heavy Bottomland range site)

Smelter-Waste Land

Smelter-waste land (Se) surrounds the zinc smelter on the northeastern edge of Henryetta. Fumes and toxic residues from the smelter have killed the vegetation. The area north and northeast of the smelter is the most severely damaged. The slope range is 3 to 12 percent. (Capability unit VIIIs–1; not placed in a range site)

Stidham Series

The Stidham series consists of deep, well-drained, nearly level soils on terraces along the Deep Fork Canadian River. These soils developed in sandy alluvium, under oak forest.

The surface layer consists of about 23 inches of loamy fine sand, pale brown in the upper part and very pale brown in the lower part. The subsoil, which is about 30 inches thick, is brownish-yellow sandy clay loam. Below a depth of 50 inches is mottled red and very pale brown sandy clay loam.

Stidham soils are medium acid to very strongly acid and low in natural fertility. They absorb water readily, but they have low water-holding capacity. These soils are easy to work. The response to fertilization is good.

Following is a description of a typical profile of a Stidham soil. This profile is in an abandoned field. It is 500 feet south and 300 feet west of the northeast corner of the SE¼ sec. 17, T. 14 N., R. 12 E.

A1—0 to 15 inches, pale-brown (10YR 6/3) loamy fine sand; brown (10YR 4/3) when moist; weak, fine, granular structure; very friable; pH 6.0; clear boundary.

A2—15 to 23 inches, very pale brown (10YR 7/3) loamy fine sand; yellowish brown (10YR 5/4) when moist; massive; very friable; pH 6.0; clear boundary.

B2t—23 to 35 inches, brownish-yellow (10YR 6/6) sandy clay loam; yellowish brown (10YR 5/6) when moist; weak, medium, subangular blocky structure; friable when moist and hard when dry; pH 6.0; gradual boundary.

B3—35 to 50 inches, brownish-yellow (10YR 6/8) sandy clay loam; yellowish brown (10YR 5/8) when moist; massive; friable when moist and hard when dry; pH 5.5; gradual boundary.

C—50 to 74 inches +, mottled red (2.5 YR 5/8) and very pale brown (10YR 7/4) sandy clay loam; massive; pH 5.0.

The depth to the B2t horizon ranges from 20 to 26 inches. The B horizon is brownish yellow to reddish yellow in color (10YR to 7.5YR in hue). In places the C horizon is fine sandy loam instead of sandy clay loam.

Stidham soils are browner than Konawa and Dougherty soils, and their subsoil is less red. They have a better developed textural and color profile than Eufaula soils. They have a lighter colored, sandier surface layer than Vanoss soils.

Stidham loamy fine sand, 0 to 2 percent slopes (ShA).—This soil has a profile like that described for the Stidham series. Included in mapping were some areas where the depth to the subsoil ranges from 15 to 20 inches rather than from 20 to 26 inches.

Nearly all of this soil has been cultivated, but now about half of it is idle or is used for pasture. (Capability unit IIIe–4; Deep Sand Savannah range site)

Strip Mines

Strip Mines (Sm) consists of areas where coal has been mined from open trenches. In these areas are ridges made up of unsorted soil material and raw clay and shale discarded during the mining operation. These ridges are 50 to 100 feet wide and 10 to 40 feet high. The trenches are 50 to 100 feet wide and 10 to 30 feet deep. Many of them are filled with water. The slopes are 3 percent or more in most places, and some cuts are nearly vertical.

Most of these areas support a little vegetation and can be lightly grazed or used as wildlife habitats. There are fish in many of the water-filled trenches. (Capability unit VIIe–1; not placed in a range site)

Talihina Series

The Talihina series consists of shallow, strongly sloping to steep soils. These soils formed under grass and overlie calcareous clay and shale.

The surface layer consists of about 8 inches of grayish-brown clay that is friable when moist and sticky and plastic when wet. The subsoil, which is about 9 inches thick, is olive-gray clay that is very firm when moist, plastic when wet, and very hard when dry. Beneath this is gray to yellowish-brown, thinly laminated shale.

Talihina soils have a slightly acid surface layer and a moderately alkaline subsoil. Runoff is rapid, and the water-holding capacity is limited.

These soils are too shallow and too steep for cultivation. They are used for native grass pasture or meadow.

The Talihina soils in this county are mapped only in a complex with the Collinsville soils. This complex is described under the heading "Collinsville series."

Following is a description of a typical profile of a Talihina soil. This profile is in a native grass pasture. It is in the northeast corner of sec. 21, T. 11 N., R. 13 E.

A1—0 to 8 inches, grayish-brown (2.5Y 5/2) light clay; very dark grayish brown (2.5Y 3/2) when moist; strong, medium, granular structure; friable when moist, plastic when wet, and hard when dry; pH 6.5; clear, wavy boundary.

B—8 to 17 inches, olive-gray (5Y 5/2) clay; dark olive gray (5Y 3/2) when moist; weak, coarse, blocky structure; very firm when moist, plastic when wet, and very hard when dry; pH 8.0; gradual boundary.

R—17 to 24 inches +, gray, grayish-brown, olive-gray, and yellowish-brown, laminated shale; soft when moist and hard when dry; pH 8.0, with seams that react with acid.

The thickness of the horizons varies greatly within short distances. The color of the A horizon is 10YR or 2.5Y in hue, and that of the lower horizons 2.5Y or 5Y.

The depth to the R horizon, which may be either shale or clay, ranges from 6 to 20 inches but is commonly between 10 and 20 inches.

Talihina soils are grayer and finer textured than Collinsville soils, and they are underlain by shale or clay rather than sandstone. They are less deep than Eram and Okemah soils and are less well developed than Eram soils.

Taloka Series

The Taloka series consists of deep, nearly level soils. These soils formed under grass, in old loess or alluvium over silty shale.

The surface layer consists of about 14 inches of grayish-brown silt loam. The subsurface layer, which is about 9 inches thick, is pale-brown silt loam faintly mottled with light brownish gray. Beneath this is 4 to more than 6 feet of mottled clay or silty clay that is very firm when moist and very hard when dry.

Taloka soils are medium acid to neutral in the lower horizons and moderately high in fertility. They absorb water slowly. During wet periods they are saturated and have a temporary water table above the clay subsoil. These soils are easy to work. The response to fertilization and other management is good. These soils are used for cultivated crops, bermudagrass pasture, and native grass pasture and meadow.

Following is a description of a typical profile of a Taloka soil. This profile is in a native grass meadow. It is 200 feet west and 50 feet north of the southeast corner of sec. 6, T. 12 N., R. 14 E.

A1—0 to 14 inches, grayish-brown (10YR 5/2) silt loam; very dark grayish-brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; friable when moist and slightly hard when dry; pH 6.0; gradual boundary.

A2—14 to 23 inches, pale-brown (10YR 6/3) silt loam; grayish-brown (10YR 5/2) when moist; faint mottles of light brownish gray (10YR 6/2); weak, fine, granular structure; few pores; friable; few fine concretions; pH 5.7; clear boundary.

B2t—23 to 36 inches, mottled light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) clay or silty clay; grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/6) when moist; moderate, coarse, blocky structure that grades to weak in the lower part; faint clay films on faces of some peds; coatings of light-gray very fine sand or silt in a few vertical cracks, and less extensive coatings in horizontal cracks; very firm when moist and very hard when dry; pH 5.7; gradual boundary.

B3—36 to 48 inches, coarsely mottled light-gray (2.5Y 7/2) and brownish-yellow (10YR 6/8) light clay; light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/8) when moist; weak, coarse, blocky structure; firm when moist, slightly plastic when wet and very hard when dry; soft, black concretions singly and in clumps; pH 6.5; gradual boundary.

C—48 to 84 inches +, mottled brownish-yellow (10YR 6/8) and light-gray (N 7/0) clay or silty clay; yellowish brown (10YR 5/8) and gray (N 5/0) when moist; massive; very firm when moist, plastic when wet, and very hard when dry; soft, black concretions; few small fragments of siltstone and sandstone; pH 7.0.

The depth to the compact B2t horizon ranges from 16 to 30 inches but is commonly between 22 and 24 inches. The boundary between the A2 and B2t horizons is abrupt or clear. In places the mottles in the horizons below the A2 include yellowish red or reddish brown. In places shale or siltstone occurs at a depth of 6 to 8 feet.

Taloka soils have a thicker A horizon than Parsons soils. They have a finer textured, more compact B2t horizon than Choteau soils.

Taloka silt loam, 0 to 2 percent slopes (TkA).—This soil occurs mainly in the east central part of the county. It has a profile similar to that described for the Taloka series. It is suited to all the crops commonly grown in the county, and most of it is cultivated. (Capability unit IIs–2; Loamy Prairie range site)

Vanoss Series

The Vanoss series consists of deep, nearly level to gently sloping soils on terraces, mostly along the Deep Fork Canadian River. These soils formed in old alluvium.

The surface layer consists of about 14 inches of brown, friable loam. The subsoil, which is about 30 inches thick, consists of yellowish-brown clay loam in the upper part and yellowish-brown sandy clay loam in the lower part. Below a depth of 44 inches is mottled sandy loam.

Vanoss soils have moderate water-holding capacity. They are medium acid and moderately high in fertility. They are easy to work. The response to fertilization and other management is good. Most of the acreage is cultivated or used for bermudagrass pasture.

Following is a description of a typical profile of a Vanoss soil. This profile is in a cultivated field. It is 900 feet east and 200 feet north of the southwest corner of sec. 13, T. 13 N., R. 12 E.

A1—0 to 14 inches, brown (10YR 5/3) loam; dark brown (10YR 3/3) when moist; weak to moderate, fine, granular structure; friable; pH 6.0; gradual boundary.

B2t—14 to 30 inches, yellowish-brown (10YR 5/4) light clay loam; dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; friable when moist and hard when dry; numerous pores and root channels; pH 6.0; gradual boundary.

B3—30 to 44 inches, yellowish-brown (10YR 5/4) light clay loam; dark yellowish brown (10YR 4/4) when moist; few, fine, faint mottles of strong brown; contains sandstonelike concretions that are soft when moist and hard when dry and that resemble mottles if broken with the soil; broken concretions are yellowish red and yellowish brown; weak subangular blocky structure; friable when moist and hard when dry; pH 6.0; gradual boundary.

C—44 to 72 inches +, coarsely mottled very pale brown (10YR 7/4), strong-brown (7.5YR 5/8), yellowish-red (5YR 5/6), and red (2.5YR 4/6) sandy loam; massive; friable when moist and hard when dry; pH 5.5

The A horizon is loam in most places, but it is fine sandy loam in some. It ranges from 12 to 18 inches in thickness but is most commonly 14 to 16 inches thick.

Vanoss soils are less sandy than Konawa, Stidham, and Dougherty soils, and they have a darker colored A horizon. They formed on higher terraces than Mason soils.

Vanoss loam, 0 to 1 percent (VoA).—This soil has a profile similar to that described for the Vanoss series, but it has a darker colored, slightly thicker surface layer. It is suited to all crops and pasture plants commonly grown

in the county. (Capability unit I–2; Loamy Prairie range site)

Vanoss loam, 1 to 3 percent slopes (VaB).—This soil (fig. 10) has a profile similar to that described for the Vanoss series. It is suited to all crops and tame pasture plants commonly grown in the county. The erosion hazard is moderate. (Capability unit IIe–1; Loamy Prairie range site)

Vanoss loam, 3 to 5 percent slopes (VaC).—The surface layer of this soil is thinner than that in the profile described for the Vanoss series. Because of the steeper slopes, runoff is greater. Some areas have shallow gullies and have lost 15 to 25 percent of the original surface layer through erosion. Most of the acreage has been cultivated, but now many areas either are idle or have been planted to bermudagrass. (Capability unit IIIe–1; Loamy Prairie range site)

Figure 10.—Profile of Vanoss loam, 1 to 3 percent slopes.

Verdigris Series

The Verdigris series consists of deep soils on bottom lands along the larger streams. These soils formed in recent alluvium, under hardwood forest. The areas along the Deep Fork Canadian River are flooded frequently, sometimes for several days; those along other streams are flooded occasionally for periods of not more than a few hours.

The surface layer consists of about 16 inches of grayish-brown or dark grayish-brown loam or silt loam. The subsoil and substratum are clay loam or silty clay loam. The substratum is mottled with brown or yellowish brown.

Verdigris soils have good water-holding capacity. They are medium acid and moderately high in fertility. They are easy to work. The response to fertilization and other management is good.

Many areas have been cleared of all but the pecan trees and are now used for cultivated crops or tame pasture.

Following is a description of a typical profile of a Verdigris soil. This profile is 600 feet north and 100 feet east of the southwest corner of the NW¼ sec. 31, T. 13 N., R. 14 E.

A—0 to 16 inches, dark grayish-brown (10YR 4/2) silt loam; very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, granular structure; friable; pH 5.5; clear boundary.

AC—16 to 32 inches, dark grayish-brown (10YR 4/2) silty clay loam; very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, subangular blocky structure; friable; pH 6.0; gradual boundary.

C—32 to 60 inches +, dark grayish-brown (10YR 4/2) silty clay loam; very dark grayish brown (10YR 3/2) when moist; faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); the entire mass crushes to dark yellowish brown (10YR 4/4) when dry; massive; few black concretions; pH 6.0.

The A horizon ranges from dark grayish brown to dark yellowish brown in color and is silt loam or loam in texture. The lower horizons range from dark grayish brown to brownish yellow in color and are generally silty clay loam or clay loam but in places are sandy clay loam.

Verdigris soils are better drained and coarser textured than Lightning and Roebuck soils. They are finer textured than Pulaski soils.

Verdigris silt loam (0 to 1 percent slopes) (Vg).—This soil has a profile similar to that described for the Verdigris series. It occurs along the larger creeks and is occasionally flooded. Except for strips of trees along the creek banks, most areas have been cleared of all but the pecan trees and are now cultivated or used for improved pasture. (Capability unit IIw–1; Loamy Bottomland range site)

Verdigris-Pulaski soils, frequently flooded (Vp).—This complex is 60 to 70 percent Verdigris loam and 30 to 40 percent Pulaski fine sandy loam. These soils cover most of the flood plains along the Deep Fork Canadian River and are frequently flooded for periods of several days.

Some areas have been cultivated, but nearly all of these are now used for bermudagrass. Most of the acreage is still forested and is used as wooded pasture and for the production of pecans. In places selected trees are harvested and sold to local sawmills. (Capability unit Vw–3; Loamy Bottomland range site)

Woodson Series

The Woodson series consists of deep, nearly level, dark-colored soils. These soils formed under grass, in material weathered from clay and shale.

The surface layer consists of about 12 inches of dark-gray silty clay loam. The subsoil, which is about 38 inches thick, is dark-gray clay that is very firm when moist and very hard when dry. Below a depth of 50 inches is lighter colored, mottled clay.

Woodson soils are very slowly permeable and have good water-holding capacity. They are harder to work than most of the soils in the county. The heavy clay subsoil restricts the root zone. These soils either are cultivated or are used for native grass pasture.

Following is a description of a typical profile of a Woodson soil. This profile is in a cultivated field. It is 700 feet west and 300 feet south of the center of sec. 6, T. 15 N., R. 12 E.

Ap—0 to 12 inches, dark-gray (10YR 4/1) silty clay loam; very dark gray (10YR 3/1) when moist; moderate, medium and fine, granular structure; friable when moist and hard when dry; pH 6.0; clear boundary.

B2t—12 to 25 inches, dark-gray (10YR 4/1) clay; black (10YR 2/1) when moist; few, fine, faint mottles of dark yellowish brown (10YR 4/4); weak, medium, blocky structure; very firm when moist, plastic when wet, and very hard when dry; pH 6.0; gradual boundary.

B3—25 to 50 inches, dark-gray (10YR 4/1) clay; very dark gray (10YR 3/1) when moist; weak, coarse, blocky structure; very firm when moist and very hard when dry; pH 6.0; gradual boundary.

C—50 to 83 inches +, mottled light brownish-gray; (2.5Y 6/2) and yellowish-brown (10YR 5/8) clay; grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) when moist; massive; very firm when moist and very hard when dry; numerous, soft, black concretions and flat fragments of siltstone; pH 8.0.

The A horizon ranges from heavy silt loam to silty clay loam in texture and from 8 to 14 inches in thickness. In places both the B2t and B3 horizons have fine, faint mottles of yellowish brown, reddish brown, or yellowish red.

Woodson soils have a darker colored, finer textured A horizon than Parsons soils. They lack the transitional A3 horizon that is characteristic of Okemah soils.

Woodson silty clay loam, 0 to 1 percent slopes (WoA).—This soil has a profile similar to that described for the Woodson series. It is suited to small grain, sorghum, and cotton. (Capability unit IIs-1; Claypan Prairie range site)

Wrightsville Series

The Wrightsville series consists of deep, poorly drained, nearly level soils on high terraces along the Deep Fork Canadian River. These soils formed in old alluvium. They are mottled throughout.

The surface layer consists of about 20 inches of gray loam that has faint mottles of dark brown or dark yellowish brown. The subsurface layer, which is about 9 inches thick, is light gray and has more mottles than the surface layer. Beneath this is a 19-inch subsoil of light brownish-gray clay mottled with light yellowish brown, red, and yellowish brown. Below a depth of 48 inches is mottled, pale-brown clay.

Wrightsville soils are medium acid or strongly acid in the upper horizons and moderately high in fertility. They are easy to work when dry. Water is absorbed slowly. Much of the time, the surface layer is saturated and there is a temporary water table above the clay subsoil. Surface drainage is very slow. Artificial drainage is needed for most crops.

Following is a description of a typical profile of a Wrightsville soil, thick surface, as mapped in this county. This profile is near the center of the SE¼NE¼ sec. 14, T. 13 N., R. 12 E.

A1—0 to 20 inches, gray (10YR 6/1) loam; dark grayish brown (10YR 4/2) when moist; common, fine and medium, faint mottles of dark brown or dark yellowish brown; weak, medium and fine, granular structure; friable when moist and hard when dry; porous; pH 5.5; gradual boundary.

A2—20 to 29 inches, light-gray (10YR 7/2) loam; grayish brown (10YR 5/2) when moist; mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); brown (10YR 4/3) when crushed and moist; weak, fine and medium, granular structure; friable when moist and hard when dry; many pores; pH 5.5; abrupt boundary.

B21t—29 to 38 inches, light brownish-gray (10YR 6/2) clay; dark grayish brown (10YR 4/2) when moist; mottles of light yellowish brown (10YR 6/4), red (2.5YR 4/6), and yellowish brown (10YR 5/6); moderate, coarse, subangular blocky structure; firm when moist and very hard when dry; vertical cracks are common and faces are thickly coated with light yellowish brown very fine sand; horizontal cracks are few and have thin coating of this sandy material; horizontal ped faces have some clay films and coatings; few soft concretions; pH 6.0; clear boundary.

B22t—38 to 48 inches, coarsely mottled light brownish-gray (10YR 6/2), light yellowish-brown (10YR 6/4), and strong-brown (7.5YR 5/6) clay; grayish brown (10 YR 5/2), yellowish brown (10YR 5/4), and strong brown (7.5YR 5/8) when moist; weak, coarse, subangular blocky structure; firm when moist and very hard when dry; vertical cracks ½ to 1 inch wide are filled with pale-brown very fine sand that forms a coating ¼ inch or more thick on surface of peds; thin sand coatings on horizontal faces of some peds; few fine concretions; pH 6.5; gradual boundary.

B3—48 to 61 inches +, pale-brown (10YR 6/3) clay; brown (10YR 4/3) when moist; common, coarse, distinct mottles of light yellowish brown and grayish brown; weak, coarse, subangular blocky structure; firm when moist and very hard when dry; discontinuous clay films on ped faces; few fine concretions; pH 7.0.

In recently cultivated areas the plow layer is not mottled. The depth to the B2t horizon ranges from 24 to 30 inches.

Wrightsville soils are less well drained than Parsons and Taloka soils, and they have a more mottled A horizon.

Wrightsville loam, thick surface (0 to 1 percent slopes) (Wr).—The surface layer of this Wrightsville soil is thicker than is typical of the series but is similar to the one in the profile described as typical of the Wrightsville soils in this county. Nearly all of this soil has been cultivated, but now most of it is in bermudagrass. (Capability unit IIIw-2; Loamy Prairie range site)

Use and Management of the Soils

This section describes how the soils in Okmulgee County can be managed for crops, pasture, range, trees, wild-

life, and engineering structures. It also explains the system of capability grouping used by the Soil Conservation Service, discusses management by capability units, and provides a table of estimated yields under two levels of management.

Management of Cropland [2]

Alfalfa, corn, cotton, peanuts, oats, rye, sericea lespedeza, soybeans, vetch, wheat, grain sorghum, and sudangrass and other forage sorghums are the principal crops grown in Okmulgee County. The major management needs in the production of these crops are fertilization, control of erosion, and maintenance of tilth.

Fertilizer should be applied in accordance with the needs of the crop and the soil, as determined by soil tests.

Effective measures for control of erosion included management of crop residue or cover crops, terracing, and contour farming. The combination of practices must depend on the nature of the soils and on the cropping system.

Tilth can be maintained by managing residue and cover crops properly, by avoiding unnecessary tillage operations, and by tilling only when the soils are within the proper range of moisture content.

An essential of management is a cropping system that supplies an ample amount of residue. In Okmulgee County, at least 3,000 pounds of residue per acre is needed to maintain soil structure and tilth and to replenish the supply of organic matter. Corn, sorghum, soybeans, oats, and wheat leave large amounts of residue. Cotton and peanuts leave only small amounts; they should be grown in rotation with high-residue crops or should be followed by cover crops.

Management of Tame Pasture

A large acreage in Okmulgee County is used for tame pasture. Bermudagrass is the most widely grown pasture grass; others commonly grown are fescue, brome, Korean lespedeza, sericea lespedeza, Ladino clover, hop clover, ryegrass, oats, rye, wheat, vetch, and sudangrass. Bermudagrass, which is suited to most of the arable soils, is grown alone or is overseeded with legumes, including Korean lespedeza, Ladino clover, and hop clover. The cool-season perennials—fescue, which does well on wet soils, and brome, which requires well-drained soils—are generally planted with or overseeded with Ladino clover and hop clover. Sericea lespedeza, a perennial legume, is used mostly for hay but is used for pasture in some places. Ryegrass, a cool-season annual, generally reseeds for several years. Oats, rye, wheat, and vetch are cool-season annuals used for pasture. Sudangrass, the most common warm-season annual, is used both for pasture and for hay.

Fertilization, in accordance with the results of soil tests, is generally needed to establish perennial pasture stands.

Practices that help to control weeds, brush, and trees in permanent pastures include control of grazing, fertilizing, mowing and spraying. If brush and trees are not controlled they eventually shade out the grass on wet bottom lands.

Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on the limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

In the capability system, soils are grouped at three levels: the capability class, the subclass, and the unit.

Capability Classes, the broadest groupings, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I. Soils have few limitations that restrict their use.

Class II. Soils have moderate limitations that reduce the choice of plants, or require moderate conservation practices.

Class III. Soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV. Soils have very severe limitations that restrict the choice of plants, require very careful management, or both.

Class V. Soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Class VI. Soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII. Soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture, range, woodland, or wildlife.

Class VIII. Soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at

[2] By Earnest O. Hill, agronomist, Soil Conservation Service.

the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs. The Arabic numeral specifically identifies the capability unit within the subclass.

Management by Capability Units

In the following pages each of the capability units in Okmulgee County is described, and suggestions for use and management are given. The capability classification of each individual soil is given in the "Guide to Mapping Units."

Capability unit I-1

This unit consists of Mason loam, a deep, nearly level soil. This soil is a few feet above the flood plains. Most areas are not flooded, but a few areas are flooded infrequently. The fertility is moderately high, the water-holding capacity is good, and water is readily available to plants.

This soil is suited to all the crops and pasture plants grown in the county. It is well suited to pecans, and pecans are harvested from native trees in many places. A suitable cropping system is 3 or 4 years of alfalfa followed by 2 years of cotton, grain sorghum, or some other row crop. Grain sorghum or other crops that leave a large amount of residue can be grown year after year if the residue is used for soil improvement.

This soil is friable and easy to work. The response to fertilizer is good.

Capability unit I-2

This unit consists of deep, nearly level soils. The fertility is moderately high, the water-holding capacity is good, and water is available to plants.

The soils in this unit are suited to all crops and pasture plants grown in the county. Corn or grain sorghum can be grown year after year if a large amount of the residue is returned to the soil.

These soils are friable and easy to work. The response to fertilization and other management is good.

Capability unit IIe-1

This unit consists of deep or moderately deep, very gently sloping soils. The fertility is moderately high or medium, the water-holding capacity is moderate or good, and water is readily available to plants. The erosion hazard is moderate.

The Choteau and Vanoss soils in this unit are suited to all crops grown in the county, but the Bates soil is too shallow to be suited to alfalfa. A suitable cropping system is 2 years of soybeans followed by 2 or 3 years of small grain.

These soils are friable and easy to work. Generally, they should be contour farmed and terraced if row crops are grown. Crop residue should be so managed as to protect the soil and maintain fertility. The response to fertilization is moderate or good.

Capability unit IIe-2

This unit consists of deep, very gently sloping soils. The fertility is moderately high, the water-holding capacity is good, and water is readily available to plants. The erosion hazard is moderate.

The soils in this unit are suited to all crops and pasture plants grown in the county. A suitable cropping system is 1 or 2 years of a row crop followed by 1 or 2 years of a crop that leaves a large amount of residue.

These soils are friable and easy to work. Generally, they should be terraced and contour farmed if row crops are grown. Crop residue should be so managed as to protect the soil and maintain fertility. The response to fertilization and other management practices is good.

Capability unit IIe-3

This unit consists of Hartsells fine sandy loam, 1 to 3 percent slopes, a moderately deep soil. This soil is strongly acid and low in fertility. It has moderate water-holding capacity. The erosion hazard is moderate.

This soil is suited to peanuts, cotton, sorghum, rye, vetch, and truck crops. Bermudagrass pasture is fair or good if fertilized but is poor if not well managed. A suitable cropping system is 2 or 3 years of peanuts followed by 1 or 2 years of grain sorghum. A cover crop, such as a mixture of winter rye and vetch, is needed after each crop of peanuts.

This soil is friable and easy to work. Generally it should be terraced and contour farmed if row crops are grown. Periodically, crop residue should be used for soil improvement. The response to fertilization and other management practices is moderate.

Capability unit IIw-1

This unit consists of Verdigris silt loam, a deep, nearly level soil. This soil is on bottom lands and is occasionally flooded. The fertility is moderately high, and the water-holding capacity is good.

This soil is suited to all the crops and pasture plants grown in the county. It is well suited to pecans, and pecans are harvested from native trees in many places. Growing small grain year after year is a suitable cropping system if a large amount of residue is used for soil improvement.

This soil is friable and easy to work. Occasional flooding is the main hazard, but flooding causes only slight damage to crops. The response to fertilizer is good.

Capability unit IIs-1

This unit consists of deep, nearly level soils that have a dense clay subsoil. These soils are moderately fertile.

They absorb water slowly and have good water-holding capacity. The heavy subsoil limits the availability of water to plants. Erosion is a problem on long slopes.

The soils in this unit are suited to small grain, sorghum, and cotton. Some alfalfa is grown. The Parsons soil is suited to peanuts and bermudagrass, but the Woodson soil is too clayey for peanuts and is only fair for bermudagrass. Wheat can be grown year after year, if the residue is used for soil improvement.

The response to fertilization is moderately good. If row crops are grown, a row arrangement that facilitates surface drainage is needed.

Capability unit IIs-2

This unit consists of Taloka silt loam, 0 to 2 percent slopes, a deep soil that has a thick surface layer and a clayey subsoil. During wet periods this soil is saturated and has a temporary water table above the subsoil.

This soil is moderately high in fertility. It absorbs water slowly but has a good water-holding capacity. The water stored in the thick surface layer is readily available to plants, but that in the subsoil is not. Water erosion is a problem on long slopes.

This soil is suited to all crops grown in the county. A suitable cropping system is either small grain grown year after year or 2 or 3 years of soybeans followed by 1 or 2 years of grain sorghum.

This soil is friable and easy to work. The response to fertilization and other management practices is good. Terracing is needed on long slopes, for control of erosion.

Capability unit IIIe-1

This unit consists of deep or moderately deep, gently sloping soils. These soils are moderately high or moderate in fertility. They have moderate or good water-holding capacity, and water is readily available to plants. The erosion hazard is moderately severe. Many areas are subject to gully erosion because they receive runoff from higher areas.

The soils in this unit are suited to small grain, vetch, and sorghum. They are also suited to bermudagrass and sericea lespedeza. Peanuts and cotton can be grown, but they do not leave enough residue to protect the soil. Corn is seldom grown. A suitable cropping system is 1 or 2 years of a row crop, such as cotton, followed by 1 or 2 years of a small grain or of some other crop that leaves a large amount of residue.

These soils are friable and easy to work. They should be terraced and contour-farmed if clean-tilled crops are grown. Crop residue should be used for soil improvement. The response to fertilization and other management practices is moderate.

Capability unit IIIe-2

This unit consists of Dennis silt loam, 2 to 5 percent slopes, eroded, a deep soil. One-half to three-fourths of the surface layer has been removed by erosion. There are small gullies that can be eliminated by tillage and, in places, deeper gullies that are difficult to cross with machinery. In many places plowing has mixed the remaining surface layer with the upper part of the subsoil. Organic matter and plant nutrients have been lost through erosion.

This soil is suited to small grain, sorghum, sericea lespedeza, and bermudagrass. Small grain can be grown year after year if the residue is used for soil improvement.

This soil is harder to work than uneroded soils. If farmed, it needs to be protected by terracing and contour farming. The response to fertilization and other management practices is moderate.

Capability unit IIIe-3

This unit consists of Parsons silt loam, 1 to 3 percent slopes, a deep soil that has a dense clay subsoil. This soil is moderately fertile. Water is absorbed slowly and, because of the dense subsoil, is not readily available to plants. As a result, the choice of crops is limited. The erosion hazard is moderately severe.

This soil is suited to small grain and sorghum. It is only fair for cotton, peanuts, sericea lespedeza, and bermudagrass. Corn and alfalfa are not commonly grown. A suitable cropping system is 2 or 3 years of small grain followed by 1 or 2 years of grain sorghum.

This soil is friable and easy to work. Contour farming and terracing are generally needed if row crops are grown. Crop residue should be used for soil improvement. The response to fertilization and other management practices is fair.

Capability unit IIIe-4

This unit consists of Stidham loamy fine sand, 0 to 2 percent slopes, a deep soil that is low in fertility. This soil absorbs water readily and has little runoff. The water-holding capacity is low, but the water held is readily available to plants. Wind erosion is a hazard if clean-tilled crops that leave no residue to protect the soil are grown.

This soil is suited to oats, rye, vetch, sorghum, cotton, peanuts, and truck crops. Bermudagrass and sericea lespedeza are suitable pasture and hay crops. A suitable cropping system is 2 years of peanuts followed by 2 years of oats.

This soil is easy to work and requires only minimum tillage. Cover crops and crop residue should be used to maintain fertility and to control erosion. A cover crop is needed following each crop of peanuts. The response to fertilization is good.

Capability unit IIIe-5

This unit consists of Okemah-Eram clay loams, 1 to 3 percent slopes. These are deep or moderately deep soils that are moderately high in fertility. The erosion hazard is moderate.

These soils are suited to oats, wheat, sorghum, cotton, soybeans, sericea lespedeza, and alfalfa. Some corn is grown. There are a few bermudagrass pastures. Wheat can be grown year after year if the residue is used for soil improvement.

These soils are somewhat sticky and hard to work. They need to be terraced and contour farmed if row crops are grown. Tillage operations should be held to a minimum and properly timed, in order to avoid soil com-

paction. Crop residue should be used regularly to maintain the soil structure. The response to fertilization is good.

Capability unit IIIw–1

This unit consists of Lightning silt loam, a deep soil that has slow surface drainage. Many areas are flooded occasionally, usually only for a few hours. This soil is moderately high in fertility. It absorbs water slowly, and water stands in low places during wet periods.

Corn, sorghum, and some cotton are grown in the better drained areas. Bermudagrass and cool-season grass and clover are the pasture crops in many areas. Pecans are harvested in many places. A suitable cropping system is 2 years of cotton followed by 3 years of small grain. All residue should be used to maintain the soil structure.

The response to fertilization is good in the better drained areas. Large amounts of residue are needed to maintain structure and to increase the rate of infiltration of water. The tillage of cropland and the grazing of pastures should be timed to prevent excessive compaction of the soil. Land smoothing improves surface drainage.

Capability unit IIIw–2

This unit consists of Wrightsville loam, thick surface, a deep, nearly level soil that has a subsoil of heavy clay. The thick surface layer of this soil is wet or saturated much of the time, partly because there is little runoff and partly because the heavy subsoil absorbs water very slowly. Surface drainage is very slow, but water stands only in a few low spots. The fertility is moderately high.

This soil is not well suited to cultivation. Corn, sorghum, cotton, and sericea lespedeza are grown. Bermudagrass does well and is grown in most areas. There are a few native pecan trees. A suitable cropping system is 3 years of a small grain, such as wheat, followed by 2 years of sorghum.

Crop residue should be used for improvement of the soil structure. Management practices that prevent excessive compaction are needed. Land smoothing improves surface drainage.

Capability unit IVe–1

This unit consists of Bates-Collinsville fine sandy loams, 1 to 5 percent slopes, which are very gently sloping to gently sloping, deep and shallow soils. These soils are moderately low in fertility. The Collinsville soil is shallow and consequently has a restricted root zone and limited water-holding capacity.

These soils are suited to small grain, grain sorghum (drilled or sown), bermudagrass, and sericea lespedeza. Growing small grain year after year is a good cropping system if the crop residue is used for soil improvement. Generally, row crops should not be grown, because of the difficulty in controlling erosion.

These soils are friable and easy to work. The response to fertilization is moderate. Terracing and contour farming are generally needed on slopes of more than 3 percent.

Capability unit IVe–2

This unit consists of Hector-Hartsells fine sandy loams, 1 to 5 percent slopes. These soils are shallow to sandstone; consequently, the water-holding capacity is limited and the root zone is restricted. The fertility is low.

These soils are suited to oats, sorghum (drilled or sown), rye, vetch, sericea lespedeza, and bermudagrass. Growing either small grain or close-growing grain sorghum year after year is a suitable cropping system.

These soils are friable and easy to work. Generally, they should not be used for row crops, because of the erosion hazard. Crop residue should be used to protect and maintain the soil. Terracing is needed on slopes of more than 3 percent. The response to fertilization is moderate.

Capability unit IVe–3

This unit consists of Konawa loamy fine sand, 3 to 8 percent slopes, a deep soil that is low in fertility. The water-holding capacity of this soil is low, but the water is readily available to plants.

This soil is suited to sorghum, rye, vetch, and sericea lespedeza. Bermudagrass is suitable for permanent pastures. Growing sorghum and small grain in various sequences is a suitable cropping system if residue is used to improve and protect the soil.

This soil is easy to work and requires little tillage, but it is easily gullied, and it is too sandy for terracing. It should be kept in hay or pasture crops most of the time. The cropping system should include close-growing crops that leave enough residue to protect the soil from erosion. The response to fertilization is good.

Capability unit IVs–1

This unit consists of Dwight-Parsons silt loams, 0 to 1 percent slopes, which are deep soils that have a thin surface layer and a subsoil of dense clay. The surface of these soils is generally uneven, and in many areas it crusts when dry. In many places there are streaks and spots of better soils that have a thicker surface layer and a more permeable subsoil.

These soils absorb water very slowly, and they have little capacity for storage of water.

Wheat and oats are about the only suitable crops, though forage sorghum can be grown in some places in favorable seasons. No pasture plants are suitable. Growing small grain year after year makes a suitable cropping system if the residue is used for soil improvement.

These soils are hard to work. Generally the only areas cultivated are small areas that extend into fields of better soils. Only crops that need little tillage should be grown.

Capability unit IVs–2

This unit consists of Eufaula fine sand, undulating, a deep soil that is low in fertility. This soil absorbs water so rapidly that there is little or no surface runoff. The water-holding capacity is limited, but the water held is readily available to plants. Fields that are bare in winter and in spring are susceptible to wind erosion.

This soil is suited to sorghum (drilled or sown), rye, vetch, and sericea lespedeza. A suitable cropping system is sown or close-rowed grain sorghum followed by a winter cover crop, such as vetch and rye.

This soil is easy to work and needs little tillage. The response to fertilization is moderate. Crop residue or cover crops should be used to protect the soil from wind

erosion. A cover crop should follow low-residue crops, such as grain sorghum.

Capability unit Vw–1

This unit consists of Ochlockonee soils, wet, which are nearly level soils that have a high water table. Although these soils are on flood plains, they are seldom flooded. In many places the water table is within a few inches of the surface during wet periods, but during dry periods it may be 30 inches or more below the surface. During wet periods water stands in low places.

These soils are friable, but they are too wet to be cultivated most of the time. The response to fertilizer is good. Almost the entire acreage is used for bermudagrass pasture or hay.

Capability unit Vw–2

This unit consists of Roebuck clay, a deep, level, poorly drained soil. This soil is on bottom lands and is frequently flooded, often for several days at a time.

This soil is not suited to bermudagrass pasture or to other tame pasture. It is too wet and too frequently flooded to be cultivated. Most areas are used as wooded pasture. In places there are a few native pecan trees.

Capability unit Vw–3

This unit consists of Verdigris-Pulaski soils, frequently flooded, which are deep soils. These soils are often under water for several days at a time. Surface drainage is good, but water stands in a few low places after floods. The water table is at a depth of 4 feet or more.

Although these soils are friable and easy to work, they are not suitable for cultivation, because of the flood hazard. They are suited to pecan trees and to tame pasture. Most areas that were once cultivated are now in bermudagrass pasture. Fescue, Ladino clover, and other cool-season pasture plants do well in most areas, as well as bermudagrass.

Capability unit Vw–4

This unit consists of Broken alluvial land. This land type is on narrow bottoms and banks along smaller creeks. Many parts of it are flooded for a few hours several times a year.

Although Broken alluvial land is loamy, friable, and well drained, it is not suitable for cultivation. It is suited to trees, pasture, and wildlife habitats. Pecan trees and other trees grow naturally. A few of the larger areas can be cleared and used for pasture, but much of the area is so narrow and broken by stream channels that the chief use is wildlife habitat.

Capability unit VIe–1

This unit consists of Dennis soils, 2 to 6 percent slopes, severely eroded. These soils have been severely damaged by both sheet and gully erosion.

These soils are not suitable for cultivation. They can be used for pasture or range, hay crops, or wildlife habitats. They should be protected from further erosion by a cover of perennial vegetation.

Bermudagrass is the best pasture plant, but sericea lespedeza can be grown in some areas.

Capability unit VIe–2

This unit consists of Konawa loamy fine sand, 3 to 8 percent slopes, severely eroded. This soil has numerous gullies that are close together, but it is only slightly eroded between the gullies.

This soil is not suitable for cultivation because the gullies are too close together. Bermudagrass is the best suited pasture plant. Native grasses also do well.

Establishing and maintaining permanent vegetation are the only feasible management practices.

Capability unit VIe–3

This unit consists of Dougherty-Eufaula complex, rolling, which is made up of deep, strongly sloping or moderately steep soils. These soils are low in natural fertility, have low water-holding capacity, and are susceptible to erosion.

Nearly the entire acreage has its original vegetation of oaks and tall grass, and many areas are used as wooded pasture. Bermudagrass can be used for permanent pasture. The soils are too steep for cultivation.

The main management problem is maintaining a cover of perennial vegetation sufficient for control of erosion. Fertilization is needed to establish and maintain cover if areas are cleared and used for tame pasture.

Capability unit VIe–4

This unit consists of Breaks-alluvial land complex, which is on the steep side slopes and along the banks and channels of narrow, shallow drainageways. The erosion hazard is severe.

This complex is not suitable for cultivation because of the erosion hazard. Most of the acreage is in native grass, but a few areas have been seeded to bermudagrass and are used for pasture.

Capability unit VIIe–1

This unit consists of Strip Mines, which is made up of pits from which coal was once mined and the steep, narrow ridges where raw clay and shale was piled up during the mining operations. The pits are generally filled with water.

These areas are not suitable for cultivation. Most could be seeded only from the air. They are used mostly as wildlife habitats. Many of the water-filled pits are used for fishing and swimming.

Capability unit VIIs–1

This unit consists of Collinsville-Talihina complex, 10 to 30 percent slopes. The soils in this complex are shallow and stony. They have limited water-holding capacity and a restricted root zone.

These soils are not suitable for cultivation. They are too stony and too shallow for bermudagrass. Almost the entire acreage is in native grass. A few small areas that are relatively free of stones can be mowed.

Capability unit VIIs–2

This unit consists of Hector complex, 5 to 30 percent slopes. The soils in this complex are shallow and stony. They have a restricted root zone and limited water-holding capacity. They are low in fertility.

These soils are not suited to cultivated crops and are too stony for bermudagrass pasture. Almost the entire acreage still has its original vegetation of blackjack oak and post oak and is used as wooded range.

Capability unit VIIIs-1

This unit consists of areas that have been damaged by salt water and other wastes of the oil industry and by smelter fumes and other wastes of the zinc industry. These areas support little vegetation and cannot be used for crops or for grazing.

Predicted Yields

Predicted yields of the main crops grown in Okmulgee County, under two levels of management, are shown in table 7. These predictions are averages for a period long enough to include both dry and wet years. Yields are considerable higher than these averages in years when the moisture supply is favorable and lower in years when the moisture supply is unfavorable.

The predictions are based partly on records of fertility studies, crop variety tests, and rotation and tillage trials by the Oklahoma Agricultural Experiment Station, and partly on information obtained, during the course of this survey, by observation and by personal communication with farmers. No predictions are given for soils not considered suitable for crops.

In columns A of table 7 are yields that can be expected under common management, or the kind of management followed by a substantial number of farmers in the county. This level of management includes (1) proper seeding rates, proper dates of planting, and efficient harvesting methods; (2) sufficient control of weeds, in-

TABLE 7.—*Estimated average acre yields of principal crops under two levels of management*

[The figures in columns A indicate yields under common management; those in columns B indicate yields under improved management. Absence of a figure indicates that the crop is not commonly grown on the particular soil, that the crop is not suited to the soil, or that the soil is not arable]

Soil	Wheat		Oats		Corn		Cotton		Peanuts		Soybeans		Alfalfa		Grain sorghum		Bermudagrass			
																	Common		Improved	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Lb. of lint	Lb. of lint	Lb.	Lb.	Bu.	Bu.	Tons	Tons	Bu.	Bu.	AUM[1]	AUM[1]	AUM[1]	AUM[1]
Bates loam, 1 to 3 percent slopes	18	27	32	44	28	40	260	375	750	1,120	14	20	1.7	2.7	28	42	3.8	5.5	5.0	7.0
Bates loam, 3 to 5 percent slopes	15	24	26	36	20	32	175	275	650	950	10	16			22	37	3.0	5.0	4.5	6.5
Bates-Collinsville fine sandy loams, 1 to 5 percent slopes	10	15	20	30			140	190							18	26	2.5	4.5	4.0	5.0
Breaks-alluvial land complex																	2.5	4.5	4.0	5.0
Broken alluvial land																	3.5	5.2	4.5	7.0
Choteau loam, 1 to 3 percent slopes	18	30	35	50	30	45	300	450	850	1,200	12	20	2.5	3.5	32	47	4.0	6.0	5.5	7.5
Collinsville-Talihina complex, 10 to 30 percent slopes																				
Dennis silt loam, 1 to 3 percent slopes	18	28	32	46	28	42	275	375	800	1,150	14	20	2.0	3.0	33	45	4.0	5.5	5.0	7.5
Dennis silt loam, 3 to 5 percent slopes	16	23	26	38							12	18			28	38	3.5	5.2	4.5	7.0
Dennis silt loam, 2 to 5 percent slopes, eroded	12	18	20	30			200	270	500	775	10	16			26	34	3.0	4.5	4.0	6.0
Dennis soils, 2 to 6 percent slopes, severely eroded																	1.5	3.5		
Dougherty-Eufaula complex, rolling																	2.0	3.0	2.5	4.0
Dwight-Parsons silt loams, 0 to 1 percent slopes	6	10	14	24																
Eufaula fine sand, undulating			14	24			120	180	600	1,100					16	25	2.0	3.0	2.5	4.0
Hartsells fine sandy loam, 1 to 3 percent slopes			22	36	18	30	150	275	650	950					20	34	3.5	5.5	4.5	6.8
Hector-Hartsells fine sandy loams, 1 to 5 percent slopes			15	25											14	22	2.5	4.0	3.5	5.0
Hector complex, 5 to 30 percent slopes																				

See footnote at end of table.

TABLE 7.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Wheat		Oats		Corn		Cotton		Peanuts		Soybeans		Alfalfa		Grain sorghum		Bermudagrass			
																	Common		Improved	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb. of lint*	*Lb. of lint*	*Lb.*	*Lb.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*AUM* [1]	*AUM* [1]	*AUM* [1]	*AUM* [1]
Konawa loamy fine sand, 3 to 8 percent slopes	----	----	14	24	----	----	----	----	600	1,100	----	----	----	----	12	20	2.5	4.5	3.5	5.5
Konawa loamy fine sand, 3 to 8 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.5	3.5	----	----
Lightning silt loam	12	17	24	36	20	34	150	225	----	----	10	18	----	----	33	42	2.9	4.5	4.0	5.0
Mason loam	20	30	40	55	35	55	300	500	1,000	1,400	18	24	3.0	4.0	35	50	5.0	7.0	6.0	8.0
Ochlockonee soils, wet	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	4.5	7.0	5.5	8.0
Oil-Waste land	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Okemah silt loam, 0 to 1 percent slopes	21	32	36	48	33	45	300	500	----	----	18	24	2.5	3.5	36	50	4.5	6.0	5.5	7.5
Okemah silt loam, 1 to 3 percent slopes	20	28	34	46	28	40	275	450	----	----	16	22	2.0	3.0	33	46	4.0	5.5	5.0	7.0
Okemah-Eram clay loams, 1 to 3 percent slopes	16	24	8	40	18	28	200	300	----	----	12	20	1.5	2.5	26	35	3.5	5.0	4.5	6.0
Parsons silt loam, 0 to 1 percent slopes	20	30	30	42	20	33	225	300	500	650	12	20	----	----	24	40	3.0	4.5	4.0	5.5
Parsons silt loam, 1 to 3 percent slopes	20	28	26	40	24	32	200	275	----	----	10	17	----	----	22	33	3.0	4.0	3.5	5.0
Roebuck clay	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.5	4.5	4.0	6.5
Smelter-waste land	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Stidham loamy fine sand, 0 to 2 percent slopes	----	----	20	32	20	35	175	300	750	1,300	----	----	----	----	22	38	3.0	5.5	4.5	6.0
Strip Mines	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Taloka silt loam, 0 to 2 percent slopes	21	32	35	50	29	45	250	375	850	1,250	15	22	2.0	3.5	33	47	3.5	5.0	4.5	6.0
Vanoss loam, 0 to 1 percent slopes	20	30	40	55	35	50	275	375	950	1,400	16	22	2.5	3.5	38	52	4.5	6.5	6.0	7.8
Vanoss loam, 1 to 3 percent slopes	18	28	35	48	32	45	250	325	900	1,250	14	20	2.0	3.0	34	47	4.0	6.0	5.8	7.5
Vanoss loam, 3 to 5 percent slopes	13	24	26	38	22	35	200	300	----	----	----	----	----	----	26	38	3.5	5.6	5.0	7.0
Verdigris silt loam	26	34	40	55	47	67	300	500	----	----	23	31	3.0	4.0	40	55	5.5	7.0	6.5	8.0
Verdigris-Pulaski soils, frequently flooded	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	3.5	5.5	5.0	7.5
Woodson silty clay loam, 0 to 1 percent slopes	18	27	22	35	16	28	225	300	----	----	10	16	----	----	20	30	2.0	3.5	2.8	4.5
Wrightsville loam, thick surface	14	22	22	35	----	----	----	----	----	----	----	----	----	----	22	32	3.0	4.5	4.0	5.5

[1] Animal-unit-months. The figures represent the number of months that 1 acre will provide grazing for 1 animal (1,000 pounds live weight), or the number of months the pasture can be grazed multiplied by the number of animal units an acre will support. For example, 1 acre of Verdigris silt loam in an improved pasture of bermudagrass under improved management will provide grazing for 4 animals for 2 months, so it has a rating of 8 animal-unit-months.

sects, and plant diseases to insure normal plant growth; (3) terracing and contour farming if appropriate; and (4) application of lime and fertilizer, in relatively small amounts, to cash crops.

The B columns show the yields that can be expected under improved management. Improved management includes the first three practices listed under common management plus (1) applying lime and fertilizer as indicated by the results of soil tests; (2) using adapted, improved crop varieties; (3) installing surface drainage, if possible, where needed; (4) managing residue and tilling by methods designed to control erosion, preserve the soil structure, increase infiltration of water, and favor seedling emergence; and (5) using a suitable cropping system.

At either level A or level B, the management of tame pasture includes distributing salt and water so as to promote uniform grazing, cross fencing so that grazing can be deferred or rotated, and controlling brush.

Range [3]

More than half the area of Okmulgee County is native range on which beef cattle are raised. Most of the stock

[3] By NEAL STIDHAM, range conservationist, Soil Conservation Service.

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are sold as weaner calves. Most of the range acreage is part of livestock farms, but there are a few large ranches. Generally, it is the shallow soils and the steep, stony soils that are used as range; the better soils are cultivated.

In well-managed areas of range, the vegetation is a mixture of grass, perennial legumes, and other forage plants. The common kinds of grass are little bluestem, big bluestem, indiangrass, and switchgrass. Rangeland is generally grazed the year round, but the forage is supplemented with hay, protein cubes, and pasture of tame grass or small grain.

Hay is harvested from about 15,000 acres of prairie rangeland. Generally only one cutting a year is made. In years when the moisture supply is favorable, an acre of well-managed meadow produces about 1½ tons of hay. A meadow from which hay has been cut early in summer can usually be grazed in winter, when the soil is firm, without damage to the stand of grass. In years when the moisture supply is good, a crop of seed can be harvested from some areas of native grassland (fig. 11).

Range sites and condition classes

Effective range management requires knowledge of the kind and quantity of forage that different soils are capable of producing and of the present condition of the vegetation in relation to the potential vegetation.

For the purpose of planning range management, soils are placed in groups called range sites. A range site is an area of range that, because of its particular combination of soil, climate, and topography, has a particular potential for the production of native forage plants.

The plants on any given range site are grouped, according to their response to grazing, as decreasers, increasers, and invaders. Decreasers are plants in the potential plant community that tend to decrease if heavily grazed. These plants are generally the tallest, most productive, and most palatable perennials. Increasers are plants in the potential community that normally increase as the decreasers decline. These plants are generally the shorter, less productive, less palatable plants. Under prolonged heavy grazing, the increasers become dominant. Invaders are plants that are not part of the original vegetation but that become established if both the decreasers and the increasers decline. They may be woody plants or herbaceous annuals or perennials, and they may originate nearby or at a great distance.

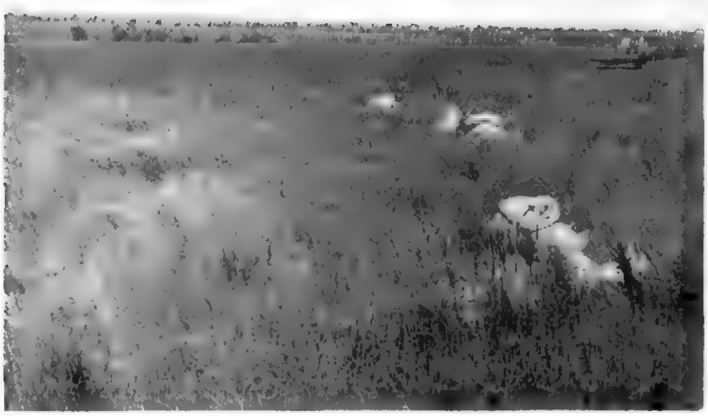

Figure 11.—**Harvesting native grass seed on well-managed rangeland. The soil is Dennis silt loam, 1 to 3 percent slopes.**

Four condition classes represent the degree to which the composition of the existing plant community is different from that of the potential plant community. Condition class is determined by estimating the relative production, by weight, of the various species that make up the existing plant community.

A range is in excellent condition if 75 to 100 percent of the present vegetation is of the same kind as the original vegetation; it is in good condition if the percentage is between 50 and 75; it is in fair condition if the percentage is between 25 and 50; and it is in poor condition if the percentage is 25 or less.

A range site in excellent condition is producing at near its maximum rate. It has a plant cover that adequately protects the soil, encourages the absorption of moisture, and helps to maintain fertility. A site in good condition has lost some of its decreaser plants, but it is still productive and can be maintained and improved by good management of grazing. A site in fair condition has a severely altered plant community in which increasers are dominant and invaders are becoming prominent. Generally the amount of litter is inadequate for protection against compaction and erosion. Such areas usually need to be closed to grazing for an entire growing season to bring about an improvement in their condition. A site in poor condition has lost almost all of the desirable forage plants, has few plants of the original vegetation, and has many invaders.

Trends in range condition are indicated by the vigor of the plants, the abundance of desirable seedlings, changes in plant composition, accumulation of plant residue, and the condition of the soil surface.

Descriptions of range sites

Eleven range sites are recognized in Okmulgee County. Descriptions of these sites, including estimates of potential yields, follow. The estimates of yields are based on samples clipped at ground level and air dried. They represent total herbage production, not production of usable forage.

The range site classification of each individual soil is shown in the "Guide to Mapping Units." Oil-Waste land, Smelter-waste land, and Strip Mines are not in any range site.

LOAMY PRAIRIE RANGE SITE

This range site consists of nearly level or gently sloping soils that have a surface layer of clay loam, loam, silt loam, or fine sandy loam. These soils have good capacity for the storage of moisture and consequently allow good development of roots.

When this site is in excellent condition, about 80 percent of the vegetation consists of decreaser grasses, 5 percent of decreaser legumes and forbs, and 15 percent of increasers. Big bluestem, little bluestem (fig. 12), indiangrass, and switchgrass are the decreaser grasses, and tickclover, leadplant, gayfeather, and sunflower are among the decreaser legumes and forbs. The increasers include dropseed, jointtail, purpletop, wild-indigo, heath aster, Scribner panicum, sticky goldenrod, and Louisiana sagewort.

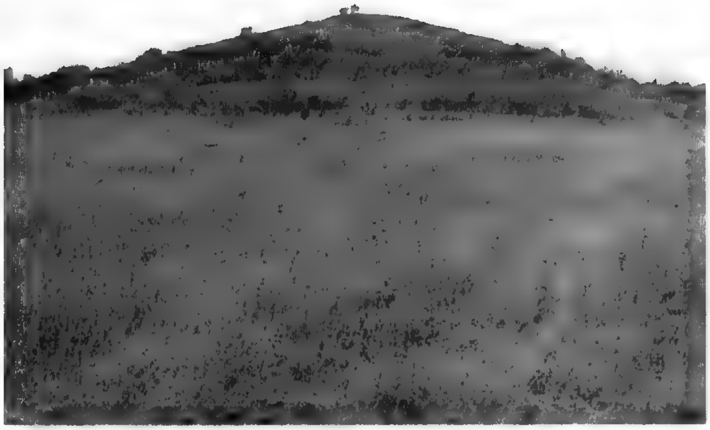

***Figure 12.*—In foreground, Loamy Prairie range site in good condition; the soil is Dennis silt loam, and the dominant vegetation is bluestem. On hill in background, Shallow Prairie range site in fair condition; the soils are Collinsville and Talihina, and the brush consists of persimmon, hawthorn, and elm.**

The common invaders in overgrazed areas are western ragweed, lanceleaf ragweed, narrowleaf sumpweed, common broomweed, white snakeroot, annual brome, annual three-awn, broomsedge bluestem, and splitbeard bluestem, and in the low places, hawthorn and persimmon.

The potential yield of herbage varies between 6,500 pounds per acre, air dry, in years of favorable moisture supply and 3,750 pounds in years of unfavorable moisture supply.

SHALLOW PRAIRIE RANGE SITE

This range site consists of shallow soils underlain by sandstone and shale. These soils have stones on or near the surface in most areas but are relatively free of surface stones in some areas. If they are not overgrazed, they have a good mulch cover and take in water well.

The vegetation on this range site is about the same as that on the Loamy Prairie range site, but potential productivity is about 25 percent less.

When this range site is in excellent condition, about 70 percent of the cover consists of climax decreaser plants and about 30 percent of increaser plants. Little bluestem, big bluestem, indiangrass, switchgrass, wildrye, tall dropseed, Virginia tephrosia, catclaw sensitivebrier, and perennial sunflower are the most abundant decreasers. Sideoats grama, meadow dropseed, silver bluestem, hairy grama, jointtail, ashy sunflower, heath aster, sticky goldenrod, coralberry, and sumac are important decreasers.

Prolonged overgrazing weakens the decreaser and increaser plants and allows plants from adjacent areas to invade. When the range site is in poor condition, both invaders and increasers are abundant. The invaders include annual brome, three-awn, splitbeard bluestem, broomsedge bluestem, ragweed, broomweed, bitter sneezeweed, hawthorn, and persimmon.

The potential yield of herbage varies between 5,000 pounds per acre, air dry, in years of favorable moisture supply and 3,000 pounds in years of unfavorable moisture supply.

ERODED PRAIRIE RANGE SITE

This range site consists of Dennis soils, 2 to 6 percent slopes, severely eroded. Erosion has removed most of the surface layer. Consequently, the fertility and the water-holding capacity have been severely reduced.

The vegetation on this site consists of indiangrass, big bluestem, and little bluestem. Maximum production is 40 to 50 percent less than that on the Loamy Prairie range site.

Deferment of grazing for an entire growing season may be necessary to protect the soils from further erosion.

The potential yield of herbage varies between 3,500 pounds per acre, air dry, in years of favorable moisture supply and 1,500 pounds in years of unfavorable moisture supply.

CLAYPAN PRAIRIE RANGE SITE

This range site consists of nearly level or very gently sloping soils that have a loamy surface layer and a subsoil of compact, slowly permeable clay. The subsoil restricts the penetration of moisture and the development of roots. During wet periods the surface layer is too wet, but during dry periods it is too dry.

When this site is in excellent condition, about 70 percent of the cover consists of climax decreaser plants and about 30 percent of increasers. Little bluestem, big bluestem, indiangrass, switchgrass, fringeleaf paspalum, purpletop, gayfeather, sunflower, and heath aster are the decreasers. Meadow dropseed, Scribner panicum, hairy grama, wild-indigo, slimflower scurfpea, and goldenrod are the increasers. Invaders include narrowleaf sumpweed, lanceleaf ragweed, bitter sneezeweed, annual brome, three-awn, jointtail, lovegrass, and broomsedge bluestem.

The potential yield of herbage varies between 5,500 pounds per acre, air dry, in years of favorable moisture supply and 4,250 pounds in years of unfavorable moisture supply.

SHALLOW CLAYPAN RANGE SITE

This range site consists of the Dwight soil in Dwight-Parsons silt loams, 0 to 1 percent slopes, an undulating soil that has a thin surface layer over a compact claypan. This soil is alternatively too wet and too dry. It receives additional moisture as runoff from nearby higher areas.

When this site is in excellent condition, 75 percent of the vegetation consists of switchgrass, little bluestem, big bluestem, buffalograss, sand dropseed, Scribner panicum, sedges, rushes, and coralberry.

If prolonged overgrazing weakens the climax plants, other plants invade. The predominant invaders are buffalograss, windmillgrass, meadow dropseed, dotted gayfeather, sand dropseed, silver bluestem, narrowleaf sumpweed, western ragweed, honeylocust, and pricklypear.

The potential yield of herbage varies between 3,000 pounds per acre, air dry, in years of favorable moisture supply and 1,500 pounds in years of unfavorable moisture supply.

DEEP SAND SAVANNAH RANGE SITE

This range site consists of deep, sandy soils on uplands. These soils can produce both oak trees and tall grasses.

When this site is in excellent condition, about 80 percent of the vegetation consists of decreaser plants and 20 percent of increasers. Of these decreasers and increasers,

about 75 percent consists of grasses and forbs and 25 percent of woody plants. Little bluestem, big bluestem, indiangrass, switchgrass, broadleaf uniola, and beaked panicum are the principal decreaser grasses and forbs. Purpletop, tall dropseed, Scribner panicum, sand lovegrass, and Texas bullnettle are among the increaser grasses and forbs. The principal trees are post oak, blackjack oak, and hickory, and there are a few red oak, flowering dogwood, huckleberry, winged elm, persimmon, and sassafras trees.

The prominent invaders in overgrazed areas are broomsedge bluestem, splitbeard bluestem, annual three-awn, showy partridgepea, ragweed, marestail, and white snakeroot. Prolonged overgrazing causes the grasses and low-growing perennials to thin out. Sprouts of post oak, blackjack oak, elm, and persimmon fill in the openings and grow into dense stands of scrubby trees.

The potential yield of herbage varies between 4,500 pounds per acre, air dry, in years of favorable moisture supply and 2,250 pounds in years of unfavorable moisture supply. These estimates apply if brush has been controlled to the point that no more than 15 percent of the surface is shaded.

SANDY SAVANNAH RANGE SITE

This range site consists of loamy soils that support a mixture of tall grasses and woody plants.

When this site is in excellent condition, about 80 percent of the vegetation consists of decreaser plants and 20 percent of increasers. About 80 percent of the increasers and decreasers are grasses, legumes, and other forbs, and 20 percent are woody plants. Little bluestem, big bluestem, indiangrass, and switchgrass are among the decreaser forage plants. Purpletop, Scribner panicum, goldenrod, aster, and perennial sunflower are the increaser grasses and forbs.

When this site is in poor condition, it appears to have a thick stand of post oak, blackjack oak, elm, hawthorn, and persimmon; a weak, thin stand of broomsedge bluestem, annual three-awn, ragweed, bitter sneezeweed, croton, and little bluestem; and only traces of other original decreasers.

The potential yield of herbage varies between 5,000 pounds per acre, air dry, in years of favorable moisture supply and 3,000 pounds in years of unfavorable moisture supply. These estimates apply only if brush has been controlled to the point that no more than 15 percent of the surface is shaded.

SHALLOW SAVANNAH RANGE SITE

This range site consists of shallow, very gently sloping to steep soils on ridges. The water-holding capacity of these soils is limited, and the penetration of plant roots is restricted. Runoff is excessive, especially when the site is in poor condition.

When this site is in excellent condition, 75 percent of the plant cover consists of grasses, legumes, and forbs, and 25 percent consists of trees. Big bluestem, little bluestem, indiangrass, and switchgrass are the dominant grasses, and there are open stands of post oak, blackjack oak, and a few hickories.

When this site is in poor condition, the stands of grass are thin, and weeds and oak sprouts invade. The site then appears to be a forest of post oak and blackjack oak sprouts. A mixed stand of grasses and trees can be restored more rapidly if the less desirable species are thinned out by the use of foliage sprays or by basal treatment with chemicals.

The potential yield of herbage varies between 4,000 pounds per acre, air dry, in years of favorable moisture supply and 2,000 pounds in years of unfavorable moisture supply. These estimates apply only if brush has been controlled to the point that no more than 15 percent of the surface is shaded.

LOAMY BOTTOMLAND RANGE SITE

This range site consists of deep, dark-colored, loamy soils that are on bottom lands. Some areas are frequently flooded.

When this range site is in excellent condition, 65 percent of the vegetation consists of tall grasses, and 35 percent of woody plants. Eastern gamagrass, prairie cordgrass, big bluestem, switchgrass, broadleaf uniola, and wildrye are among the grasses. Pecan, walnut, indigobush, passionvine, and trumpetvine are among the woody plants.

When the site is in poor condition, the plant mixture consists principally of johnsongrass, bermudagrass, pecan sprouts, trumpetvine, seacoast sumpweed, marestail, ragweed, white snakeroot, hawthorn, and persimmon. A little indiangrass, big bluestem, and switchgrass may remain.

The potential yield of herbage varies between 10,000 pounds per acre, air dry, in years of favorable moisture supply and 6,000 pounds in years of unfavorable moisture supply.

HEAVY BOTTOMLAND RANGE SITE

This range site consists of deep, poorly drained and somewhat poorly drained, nearly level soils that are alternately waterlogged and too dry.

When this site is in excellent condition, 60 to 70 percent of the vegetation consists of herbaceous plants and 30 to 40 percent of woody plants. A large part of the climax vegetation consists of cool-season plants, mainly wildrye, uniola, sedges, and rushes. Switchgrass, prairie cordgrass, big bluestem, and Florida paspalum are abundant in the better drained areas. The woody plants consist of American elm, pecan, walnut, poison-ivy, and indigobush.

When the site is in poor condition, the vegetation consists of increasers and invaders. Sumpweed, buffalograss, meadow dropseed, ragweed, and windmillgrass are abundant increasers. Hawthorn, elm, persimmon, ash, pecan sprouts, and trumpetvine are common invaders.

The potential yield of herbage varies between 7,000 pounds per acre, air dry, in years of favorable moisture supply and 3,500 pounds in years of unfavorable moisture supply.

SUBIRRIGATED RANGE SITE

This range site consists of Ochlockonee soils, wet, which is about 2 to 5 feet above the flood plain of the Deep Fork Canadian River. This site is seldom flooded. The water table ranges from the surface to a depth of 30 inches, depending on the season and the place. Water stands in the low spots most of the time.

The climax vegetation was a hardwood forest and, in the better drained areas, forage plants, including wildrye, uniola, panicum, switchgrass, and switchcane.

Most of this site has been cleared, cultivated, and abandoned. Bermudagrass grows on much of the acreage, but the vegetation in many areas consists of broomsedge bluestem and a few other low-quality perennials.

The potential yield of herbage varies between 5,000 pounds per acre, air dry, in years of favorable moisture supply and 4,000 pounds in years of unfavorable moisture supply.

Woodland, Windbreaks, and Post Lots [4]

Native woodland in Okmulgee County occurs on the bottom lands of the Deep Fork Canadian River, the Canadian River, and the larger creeks in the sandy uplands, and in rough, broken, stony areas. Only the bottom-land soils support commercial stands of timber. The others support only scrubby growths of blackjack oak, post oak, hickory, and hawthorn.

The woodland on bottom lands has deteriorated in quality and in proportion of merchantable trees because of frequent fires, injurious grazing, and the cutting of the choice trees. Where flooding can be controlled and drainage improved, the trend has been to clear the soils so that crops can be grown.

Native trees of value and beauty include bur oak, red oak, water oak, pecan, American elm, cottonwood, sycamore, red mulberry, hackberry, black walnut, green ash, white ash, redbud, dogwood, and redcedar.

Farmstead windbreaks make farmhouses more comfortable and help to shield livestock in bad weather. They are especially needed where the native vegetation does not include trees.

Multiple-row windbreaks, consisting of three to six rows of trees, are generally preferred for protecting farmsteads in Okmulgee County. Such windbreaks consist of one or two rows of rapidly growing, tall trees, such as cottonwood, sycamore, pecan, and American elm, and one or more rows of more slowly growing, intermediate-height trees, which include ash, mulberry, walnut, honeylocust, black locust, and such evergreens as Austrian pine, ponderosa pine, shortleaf pine, loblolly pine, Arizona cypress, and eastern redcedar. The evergreens furnish year-round protection, and they add to the attractiveness of the windbreak. They live longer than most deciduous trees. One row of low-growing shrubs or shrubby trees should be planted on the windward side of the windbreak.

Field windbreaks protect soils that tend to blow. There is little need or demand for them in Okmulgee County, because the areas where they might be useful are generally protected by a good ground cover.

Post lots established in Okmulgee County need careful management. Black locust, catalpa, Osage-orange (bois d'arc), and red mulberry are all suitable trees.

The soils in Okmulgee County have been placed in four groups according to their suitability for windbreak and post-lot plantings. Each group consists of soils that have about the same potential for producing the same kinds of trees under similar management. The "Guide to Mapping Units" shows which group each soil is in. The groups are described in the following paragraphs.

Group I consists of deep, nearly level to moderately steep, loamy soils on uplands and bottom lands. These soils have high water-holding capacity and are moderately well drained or well drained. Their suitability for post-lot or windbreak plantings is superior. The trees suitable for the tall row in farmstead windbreaks include cottonwood, sycamore, American elm, Siberian elm, and pecan. Generally suitable for the intermediate-height row are white ash, green ash, Russian (white) mulberry, black walnut, honeylocust, black locust, catalpa, red mulberry, Osage-orange (bois d'arc), Austrian pine, ponderosa pine, shortleaf pine, loblolly pine, Arizona cypress, and eastern redcedar. Trees that can be considered for the shrub row are common lilac, American plum, and some of the low-growing commercial varieties of juniper. Russian mulberry can also be used in the shrub row if pruned so that it produces dense foliage. Black locust, catalpa, red mulberry, and Osage-orange are suitable for fenceposts.

All the soils in this group have fair to good potential for commercial production of oak and cottonwood trees.

Group II consists of deep or moderately deep, nearly level to moderately steep, loamy or sandy soils. These soils have moderate to high water-holding capacity and are somewhat excessively drained to somewhat poorly drained. The root zone is adequate for trees.

These soils have limitations for windbreak and post-lot plantings. In dry seasons, many seedlings die and replanting is necessary. Nevertheless, trees can be established if extra care is taken in planting and management. The trees suitable for the tall row in farmstead windbreaks include sycamore, American elm, Siberian elm, and pecan. Cottonwood can be used if the soils are sandy, and it grows well on soils that have a fairly high water table. Generally suitable for the intermediate-height row are white ash, green ash, Russian (white) mulberry, black walnut, honeylocust, black locust, catalpa, red mulberry, Osage-orange, Austrian pine, ponderosa pine, shortleaf pine, Arizona cypress, and eastern redcedar. Loblolly pine is also suitable for the intermediate-height row if the soils are sandy, and it grows well on soils that have a fairly high water table. Trees that can be considered for the shrub row are common lilac, American plum, and some of the low-growing commercial varieties of juniper. Russian mulberry can also be used in the shrub row if pruned so that it grows a dense foliage.

The soils in this group do not have any potential for commercial timber production under present technology.

Group III consists of shallow to deep, nearly level to steep soils on uplands and bottom lands. These soils have low to high water-holding capacity and are poorly drained to somewhat excessively drained. Shallowness, a restricted root zone, an erosion hazard, unfavorable texture, and droughtiness make these soils generally unsuitable for post-lots and seriously limit their suitability for windbreaks. Only ash, mulberry, Siberian elm, honeylocust, Arizona cypress, and eastern redcedar should be planted for windbreaks. Osage-orange, though slow growing, is suitable for Lightning, Parsons, and Roebuck soils and could be used for fenceposts. Fenceposts and Christmas trees can be grown in some areas of Strip Mines, but in-

[4] By CHARLES P. BURKE, woodland conservationist, Soil Conservation Service.

vestigation of each site is advisable before planting, because the soil in some areas is toxic to seedlings.

These soils do not have any potential for commercial timber production.

Group IV consists of shallow to deep, nearly level to steep, somewhat excessively drained to somewhat poorly drained soils on uplands. Shallowness, steepness, toxicity, erosion hazard, clayey subsoil, and droughtiness make these soils generally unsuitable for windbreaks and post lots.

Wildlife [5]

The three kinds of wildlife areas in Okmulgee County are prairie, which makes up more than half the county, timbered uplands, and timbered bottom lands. The changes in vegetation that result from different uses of the various soils are generally favorable to wildlife. Among the changes that may be detrimental are mowing the native range and using for pasture areas where wildlife have been dependent upon cultivated crops for additional food.

The important kinds of wildlife in the county are bobwhite quail, mourning dove, waterfowl, squirrel, deer, cottontail, raccoon, mink, opossum, skunk, and muskrat. Predators are fox, wolf, coyote, bobcat, hawks, and owls. There are many kinds of songbirds. Sunfish, channel catfish, bullhead catfish, flathead catfish, carp, buffalofish, and bass inhabit the ponds and streams of the county.

The availability of food and cover for wildlife coincides in a general way with the soil associations. Descriptions of the associations are in the section "General Soil Map."

Association 1, which consists mainly of Dennis, Bates, and Parsons soils, association 2, which consists mainly of Taloka soils, and association 3, which consists mainly of Okemah and Woodson soils, are used for cultivated crops, range, tame pasture, and native meadow. This pattern of land use is favorable for wildlife. A larger wildlife population could be supported if field borders, fence rows, banks of ponds, wooded banks of streams, and odd-shaped areas not suitable for other uses were developed as wildlife habitats. Along some of the drainageways are elm, oak, hackberry, pecan, walnut, sumac, greenbrier, and blackberry, which provide cover for several kinds of wildlife. Numerous farm ponds support fish.

Association 4, which consists mainly of Collinsville and Talihina soils, is used chiefly as range, but small areas are used for cultivated crops and meadow. This pattern of land use limits wildlife cover. Good management of food and cover would result in an increase in the wildlife population. Ponds built to supply water for livestock also support fish.

Association 5, which consists mainly of Hector and Hartsells soils, is used chiefly as wooded range, and only small areas are cultivated. The wooded areas have a cover of blackjack oak, post oak, and some grass and and are good habitats for deer, squirrel, wild turkey, and quail. Small populations of some kinds of wildlife can be maintained even if no effort is made to improve the habitats, but larger numbers could be attracted by developing fringe areas in such a way as to increase the food supply. Most farm ponds support fish.

Association 6, which consists mainly of Konawa and Stidham soils, is along the Deep Fork Canadian River in upland areas that originally supported a forest of oak. About half the acreage has been cultivated but is now mostly idle or used for range and pasture. The small acreage now cultivated, however, supplies a large amount of food for wildlife. The vegetation, the location near bottom lands, and the pattern of land use are favorable for wildlife.

Association 7, which consists mainly of Verdigris, Lightning, and Pulaski soils, is on bottom lands where the natural vegetation consists of trees, grasses, shrubs, and weeds. Among the trees are hackberry, ash, oak, cottonwood, pecan, walnut, and willow. About half the acreage has been cultivated, but much of it is now tame pasture or is growing up to brush. The vegetation, the water supply, and the pattern of land use are favorable for such animals as deer, squirrel, mink, muskrat, and beaver. Waterfowl use areas where the water is clear enough to support aquatic plants. Bullhead catfish, carp, and buffalofish are plentiful in the Deep Fork River, and sunfish, blackbass, and channel catfish in the smaller, less turbid streams.

Engineering Properties of the Soils [6]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. The properties most important to engineers are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and reaction (pH). Depth to water table, depth to bedrock, and topography are also important.

Information in the report can be used to—

1. Make studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of soil properties that are significant in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other construction materials.
5. Correlate performance of engineering structures with soil mapping units to develop information for overall planning that will be useful in designing and maintaining engineering structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.

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[5] By Jerome F. Sykora, biologist, Soil Conservation Service.

[6] Prepared by Forrest McClung, engineer, Soil Conservation Service.

7. Supplement the information obtained from other published maps and reports and aerial photographs to make maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and excavations deeper than the depth of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Agricultural and engineering classification systems

The system of classifying soils used by the American Association of State Highway Officials (AASHO)[7] is based on field performance of the soils in highways. In this system soils are placed in seven principal groups. The groups range from A-1, which consists of gravelly soils of high bearing capacity, to A-7, which consists of clayey soils that have low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index. Group indexes range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol, for example, A-6(9).

The Unified classification[8] is based on the identification of soils according to texture, plasticity, and performance as material for engineering structures. Soil materials are identified as coarse grained—gravel (symbol G) and sand (symbol S); fine grained—silt (symbol M) and clay (symbol C); and highly organic—(symbol O). In this system, clean sand is designated by the symbols SW and SP; silty or clayey sand by the symbols SM and SC; silt or clay that has a low liquid limit by the symbols ML and CL; and silt or clay that has a high liquid limit by the symbols MH and CH.

The system used by the U.S. Department of Agriculture (USDA)[9] is primarily for agricultural use. It is helpful to engineers, however, because it classifies soil material according to texture. Of primary importance in this system is the relative proportion of the various-sized individual grains in a mass of soil. Textural classes are based on different combinations of sand (2.0 millimeters to 0.05 millimeter in diameter), silt (0.05 to 0.002 millimeter), and clay (less than 0.002 millimeter). The basic classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. Sands are further identified as very coarse, coarse, fine, and very fine. Soils containing gravel up to 3 inches in diameter are gravelly; soils containing stones more than 10 inches in diameter are stony; soils containing flattened fragments of shale less than 6 inches along the longer axis are shaly; and soils containing relatively thin fragments of sandstone, limestone, slate, or shale, 6 to 15 inches long, are flaggy.

Estimated engineering properties

Table 8 shows estimates of soil properties that affect engineering. These estimates are based on available test data for the modal, or typical, profiles. Estimates of properties of soils not tested are based on test data for similar soils in this county or other counties and on past experience in engineering construction. Since the estimates are for modal soils, considerable variation from the values shown in table 8 should be anticipated. More information on the range of properties of the soils can be obtained from the section "Descriptions of the Soils." Complete profile descriptions are given in the section "Genesis, Classification, and Morphology of the Soils."

The column headed "Permeability of least permeable layer" indicates the rate at which water moves through undisturbed soil material. The estimates are based on soil structure and porosity. Mechanically developed features, such as plowpans and surface crusting, have not been considered. In table 8 the rates are expressed in inches per hour, which can be expressed verbally as follows:

Inches per hour	
Less than 0.05	Very slow
0.05 to 0.20	Slow
0.20 to 0.80	Moderately slow
0.80 to 2.50	Moderate
2.50 to 5.00	Moderately rapid
5.00 to 10.00	Rapid
More than 10.00	Very rapid

Available water capacity refers to the amount of capillary water in a soil that is wet to field capacity. If the moisture content is at the wilting point for plants, this amount of water will wet the soil material described to a depth of 1 inch without deeper percolation.

Reaction (pH) refers to the degree of acidity or alkalinity of a soil. The degrees of acidity or alkalinity are defined under "Reaction" in the Glossary.

The column headed "Shrink-swell potential" indicates the volume change to be expected with a change in moisture content. The estimates are based on volume-change tests or observed physical properties and characteristics of the soil. For example, soil material from the A horizon of Roebuck clay is very sticky when wet and develops extensive shrinkage cracks when dry; hence, it has a high shrink-swell potential. Material from the A horizon of Eufaula fine sand is structureless and nonplastic, and it therefore has a low shrink-swell potential.

Engineering interpretations

Table 9 lists, for each soil in Okmulgee County, interpretations of its features or characteristics that may affect its suitability for specific engineering purposes. These interpretations are based on the information in table 8, on available test data, and on field experience.

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[7] AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Part 1, Ed. 8, 1961.

[8] WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS. UNIFIED SOIL CLASSIFICATION SYSTEM. Tech. Memo. No. 3-357, v. 1, 1953.

[9] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY MANUAL, U.S. Dept. Agr. Handb. 18, 503 pp., 1951.

TABLE 8.—*Estimated properties*

Soil series and map symbol	Depth from surface	Classification	
		USDA texture	Unified
	In.		
Bates (BaB, BaC)	0 to 24	Loam	ML, CL
	24 to 38	Clay loam	CL
	38	Sandstone	
Bates (BcC) (For Collinsville part of this unit, see Collinsville series).	0 to 11	Fine sandy loam	SM
	11 to 22	Loam	ML, CL
	22	Sandstone	
Breaks-alluvial land (Bk)	(1)	(1)	(1)
Broken alluvial land (Bu)	(1)	(1)	(1)
Choteau (ChB)	0 to 25	Loam	ML, CL
	25 to 48	Clay loam	CL
	48 to 62	Clay loam	CL
Collinsville (CtE) (For Talihina part of this unit, see Talihina series.)	0 to 8	Fine sandy loam	SM
	8	Sandstone	
Dennis (DeB, DeC, DeC2, DsC3)	0 to 16	Silt loam	ML, CL
	16 to 36	Clay loam	CL
	36 to 88	Clay	CL, CH
Dougherty (Dt) (For Eufaula part of this unit, see Eufaula series.)	0 to 30	Loamy fine sand	SM
	30 to 50	Sandy clay loam	SC, CL
	50 to 70	Loamy fine sand	SM
Dwight (DwA) (For Parsons part of this unit, see Parsons series.)	0 to 6	Silt loam	ML, CL
	6 to 60	Clay	CL, CH
Eram	0 to 10	Clay loam	CL
	10 to 30	Clay	CH, MH
	30 to 40	Shale	
Eufaula (EuB)	0 to 60	Fine sand	SM, SP
Hartsells (HaB)	0 to 12	Fine sandy loam	SM
	12 to 32	Sandy clay loam	SC, CL
	32	Sandstone	
Hector (HhC, HtE) (For Hartsells part of HhC, see Hartsells series.)	0 to 13	Fine sandy loam	SM
	13	Sandstone	
Konawa (KsD, KsD3)	0 to 16	Loamy fine sand	SM
	16 to 58	Sandy clay loam	SC, CL
	58 to 70	Fine sandy loam	SM, ML
Lightning (Lg)	0 to 11	Silt loam	ML
	11 to 20	Silty clay loam	CL
	20 to 60	Clay	CL, CH
Mason (Ms)	0 to 28	Loam	ML, CL
	28 to 64	Clay loam	CL
Ochlockonee (Oc)	0 to 65	Fine sandy loam	SM
Oil-Waste land (Od)	(1)	(1)	(1)
Okemah (OkA, OkB, OrB) (For Eram part of OrB, see Eram series.)	0 to 12	Silt loam	ML
	12 to 21	Silty clay loam	CL
	21 to 62	Clay	CH, MH
Parsons (PaA, PaB)	0 to 12	Silt loam	ML
	12 to 62	Clay	CL, CH
Pulaski	0 to 65	Fine sandy loam	SM
Roebuck (Rc)	0 to 60	Clay	CL, CH

See footnote at end of table.

significant in engineering

Classification—Continued AASHO	Percentage passing sieve— No. 4	No. 10	No. 200	Permeability of least permeable layer	Available water capacity	Reaction	Shrink-swell potential
				In. per hr.	*In. per in. of soil*	*pH*	
A-4	100	100	55 to 85	0.8 to 2.5	0.14	5.5 to 6.5	Low.
A-6	100	100	75 to 95		.17	5.5 to 6.5	Moderate.
A-4	100	100	36 to 50	0.8 to 2.5	.14	5.5 to 6.5	Low.
A-4	100	100	55 to 85		.14	5.5 to 6.5	Low.
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1).
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1).
A-4	100	100	55 to 85	0.2 to 0.8	.14	5.1 to 6.0	Low.
A-6	100	100	75 to 95		.17	5.5 to 7.0	Moderate.
A-6, A-7	100	100	75 to 95		.17	6.5 to 8.0	Moderate or high.
A-4	100	100	36 to 50	2.5 to 5.0	.14	5.5 to 6.5	Low.
A-4	100	100	75 to 90	0.05 to 0.20	.14	5.1 to 6.0	Low.
A-6	100	100	75 to 95		.17	5.1 to 6.0	Moderate.
A-7	100	100	90 to 100		.17	6.7 to 8.0	Moderate.
A-2	100	100	11 to 30	0.8 to 2.5	.07	5.5 to 6.5	Low.
A-4	100	100	40 to 60		.12	5.0 to 6.0	Low.
A-2	100	100	20 to 35		.09	5.0 to 6.0	Low.
A-4	100	100	75 to 90	<0.05	.14	5.5 to 6.5	Moderate.
A-7	100	100	90 to 100		.17	6.5 to 8.6	High.
A-6	100	100	75 to 95	0.05 to 0.20	.17	5.6 to 6.5	Moderate.
A-7	100	100	90 to 100		.17	6.5 to 8.0	High.
A-3	100	100	5 to 10	5 to 10	.05	5.0 to 6.0	Low.
A-2	100	100	20 to 35	0.8 to 2.5	.12	5.1 to 6.0	Low.
A-4	100	100	40 to 60		.12	4.5 to 5.5	Low.
A-4	100	100	36 to 50	2.5 to 5	.14	5.0 to 6.0	Low.
A-2	100	90 to 100	15 to 35	0.8 to 2.5	.07	5.5 to 6.5	Low.
A-4	100	100	40 to 60		.12	5.0 to 6.0	Moderate.
A-4	100	100	36 to 55		.14	5.0 to 6.5	Low.
A-4	100	100	75 to 90	<0.05	.14	5.1 to 6.0	Moderate.
A-6, A-7	100	100	85 to 95		.17	5.5 to 6.5	Moderte.
A-7	100	100	90 to 100		.17	6.5 to 8.0	High.
A-4	100	100	55 to 85	0.2 to 0.8	.14	5.5 to 6.5	Low.
A-6	100	100	75 to 95		.17	5.5 to 6.5	Moderate.
A-2, A-4	100	100	25 to 45	2.5 to 5	.14	5.0 to 6.0	Low.
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1).
A-4	100	100	85 to 95	0.05 to 0.2	.14	5.6 to 6.5	Low.
A-6, A-7	100	100	85 to 95		.17	5.6 to 6.5	Moderate.
A-7	100	100	90 to 100		.17	6.5 to 8.0	High.
A-4	100	100	75 to 90	<0.05	.14	5.1 to 6.0	Low.
A-7	100	100	90 to 100		.17	6.1 to 8.0	High.
A-2, A-4	100	100	20 to 50	2.5 to 5	.12	5.6 to 6.5	Low.
A-7	100	100	90 to 100	<0.05	.17	6.5 to 8.0	High.

TABLE 8. *Estimated properties*

Soil series and map symbol	Depth from surface	Classification	
		USDA texture	Unified
Smelter-waste land (Se)	([1])	([1])	([1])
Stidham (ShA)	0 to 23	Loamy fine sand	SM
	23 to 74	Sandy clay loam	SC, CL
Strip Mines (Sm)	([1])	([1])	([1])
Talihina	0 to 17	Clay	CL, CH
	17	Shale	
Taloka (TkA)	0 to 23	Silt loam	ML
	23 to 84	Clay or silty clay	CL, CH
Vanoss (VaA, VaB, VaC)	0 to 14	Loam	ML, CL
	14 to 44	Clay loam	CL
	44 to 72	Sandy loam	SM
Verdigris (Vg, Vp)	0 to 16	Silt loam	ML, CL
(For Pulaski part of Vp, see Pulaski series.)	16 to 60	Silty clay loam	ML, CL
Woodson (WoA)	0 to 12	Silty clay loam	ML
	12 to 83	Clay	CL, CH
Wrightsville (Wr)	0 to 29	Loam	ML, CL
	29 to 61	Clay	CL, CH

[1] Properties variable.

Normally, only the surface layer of a soil is rated for topsoil. The suitability of this layer depends largely upon its texture and depth. Topsoil material must be capable of being worked into a good seedbed for seeding or sodding, yet be clayey enough to resist erosion on steep slopes. The thickness of the layer of suitable material determines whether or not it is economical or wise to remove it.

The suitability rating for select material depends mainly upon the grain size and the kind of binding material that holds the material together. Soils that are predominantly sand are good if a binder is added for cohesion. Clay soils compress under load and rebound when unloaded; thus, they are rated poor.

Most kinds of soil material are used as road fill. Some soils, such as sandy clay and sandy clay loam, offer few problems in placement or compaction. Clay, which has a high shrink-swell potential, requires special compaction techniques and close moisture control both during and after construction. Sand compacts well but is difficult to confine in a fill. The rating reflects the ease with which these problems can be overcome.

The last column in table 9 shows the classification of the soils in four hydrologic soil groups. The entire soil profile is considered, to the greatest depth shown in the column headed "Depth from surface" in table 8. The classification is based on intake of water at the end of a long-duration storm that occurred after the soil had had prior wetting and an opportunity for swelling and when the soil was without the protection of vegetation. Group A consists mostly of sandy soils that have the lowest runoff potential. Group D consists mostly of clays that have the highest runoff potential.

Engineering test data

Table 10 shows test data for soil samples collected during the survey of Okmulgee County and tested by the State Highway Department. Test data for some of the other soils may be found in other published soil surveys.

As moisture leaves a soil, the soil shrinks and decreases in volume in proportion to the loss in moisture, until a point is reached where shrinkage stops, even though additional moisture may still be removed from the soil. The moisture content at which shrinkage stops is called the shrinkage limit. The shrinkage limit of a soil is a general index of clay content and generally decreases as the clay content increases. The shrinkage limit of sand that contains little or no clay gives a test result that is close to the liquid limit and, therefore, is considered insignificant. As a rule, the load-carrying capacity of a soil is at a maximum when its moisture content is at or below the shrinkage limit. Sand is an exception. If confined, it has a uniform load-carrying capacity within a considerable range in moisture content.

The shrinkage ratio is calculated by dividing the volume change resulting from the drying of a soil material by the amount of moisture lost. The volume change used in computing shrinkage ratio is the change in volume that will take place in a soil when it dries from a given moisture content to the point where no further shrinkage takes place.

The field moisture equivalent is the minimum moisture

significant in engineering—Continued

Classification—Continued	Percentage passing sieve—			Permeability of least permeable layer	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200				
			In.	In. per hr.	In. per in. of soil	pH	
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1).
A-2	100	100	11 to 30	0. 8 to 2. 5	. 07	5. 5 to 6. 5	Low.
A-4	100	100	40 to 60		. 12	5. 0 to 6. 0	Low.
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1).
A-7	100	100	90 to 100	0. 05 to 0. 20	. 17	6. 5 to 8. 0	High.
A-4	100	100	75 to 90	<0. 05	. 14	5. 1 to 6. 0	Moderate.
A-7	100	100	90 to 100		. 17	6. 0 to 8. 0	High.
A-4	100	100	55 to 85	0. 8 to 2. 5	. 14	5. 5 to 6. 5	Low.
A-6	100	100	75 to 95		. 17	5. 5 to 6. 5	Moderate.
A-4	100	100	36 to 50		. 14	5. 5 to 6. 5	Low.
A-4	100	100	75 to 90	0. 2 to 0. 8	. 14	5. 1 to 6. 0	Low.
A-4, A-6	100	100	85 to 95		. 17	5. 0 to 6. 0	Moderate.
A-4, A-6	100	100	85 to 95	<0. 05	. 17	5. 6 to 6. 5	Moderate.
A-7	100	100	90 to 100		. 17	6. 0 to 8. 0	High.
A-4	100	100	55 to 85	<0. 05	. 14	5. 0 to 6. 0	Low.
A-7	100	100	90 to 100		. 17	6. 0 to 8. 0	High.

content at which a smooth soil surface will absorb no more water in 30 seconds when the water is added in individual drops. It is the moisture content required to fill all the pores in sand and to approach saturation in cohesive soils. The volume change from field moisture equivalent is the volume change, expressed as a percentage of the dry volume, of the soil mass when the moisture content is reduced from the field moisture equivalent to the shrinkage limit.

In mechanical analysis, the soil components are sorted by particle size. Sand and other granular material are retained on a number 200 sieve. Silt-clay materials are those soil particles smaller than the openings in a number 200 sieve. Clay is the fraction smaller than 0.005 millimeter in diameter. The material intermediate in size between that held on the No. 200 sieve and that having a diameter of 0.005 millimeter is called silt.

The tests for liquid limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plasticity limit. It indicates the range of moisture content within which the soil material is plastic.

Genesis, Classification, and Morphology of the Soils

This section presents the outstanding morphologic characteristics of the soils of Okmulgee County and relates them to the factors of soil formation. The first part deals with the formation of the soils, and the second part with the classification and morphology of the soils.

Factors of Soil Formation

The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are the active factors in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the active factors to change the parent material into a soil. Usually a long time is required for the development of distinct horizons.

TABLE 9. *-Interpretation of*

Soil series and map symbols	Suitability as source of—			Soil features affecting engineering practices
	Topsoil	Select grading material	Road fill	Highway location
Bates (BaB, BaC)	Surface layer fair; easily eroded if used on steep slopes.	Surface layer fair; subsoil unsuitable.	Fair: Close control of moisture necessary.	Sandstone at a depth of about 3½ feet; close control of moisture necessary.
Bates-Collinsville (BcC)	Poor: fair quality but limited quantity.	Poor: limited quantity	Poor or fair: sandstone at a depth of about 1 to 2 feet.	Sandstone at a depth of about 1 to 2 feet.
Breaks-alluvial land (Bk)	(1)	(1)	(1)	(1)
Broken alluvial land (Bu)	(1)	(1)	(1)	(1)
Choteau (ChB)	Fair or good to a depth of about 2 feet.	Poor or fair to a depth of about 2 feet; unsuitable below a depth of 2 feet.	Poor: close control of moisture necessary; unstable when wet.	Unstable when wet
Collinsville-Talihina (CtE):				
Collinsville	Poor: fair quality but limited quantity of material.	Fair	Poor or fair: sandstone at a depth of about 1 foot.	Poor or fair: sandstone at a depth of about 1 foot.
Talihina	Poor: surface rocks; shallow.	Unsuitable	Poor	Rough, broken topography.
Dennis (DeB, DeC, DeC2, DsC3).	Surface layer fair: easily eroded if used on steep slopes.	Poor: too elastic; unstable when wet.	Poor: unstable when wet; subsoil is moderately to highly plastic; difficult to compact.	Unstable when wet; slow internal drainage.
Dougherty-Eufaula (Dt)	Poor: easily eroded; low fertility.	Good to fair; may need binder.	Good if slopes are stabilized.	Moderately steep topography; cuts easily eroded.
Dwight-Parsons (DwA):				
Dwight	Poor: clay at a depth of about 6 to 12 inches.	Unsuitable: clay at a depth of about 6 to 12 inches.	Poor: unstable when wet; dispersed clay subsoil.	Highly plastic; very slow internal drainage.
Eufaula (EuB)	Unsuitable: too sandy.	Good: may need binder.	Good if sand is confined and slopes are stabilized.	Cuts easily eroded
Hartsells (HaB)	Poor: easily eroded	Good	Good	Cuts easily eroded

See footnote at end of table.

engineering properties of soils

Soil features affecting engineering practices—Continued							Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways		
Reservoir area	Embankment						
Rock at a depth of 3 to 4 feet.	Features favorable	Not needed; good natural drainage.	Sloping topography	Features favorable	Features favorable		B.
Sandstone at a depth of about 1 to 2 feet; water may seep through the sandstone.	Limited quantity of borrow material; rocks.	Not needed; good natural drainage	Sloping topography; sandstone at a depth of about 1 to 2 feet.	Sandstone at a depth of about 1 to 2 feet.	Sandstone at a depth of about 1to 2 feet; low water-holding capacity.		B.
(1)	(1)	(1)	(1)	(1)	(1)		(1).
(1)	(1)	(1)	(1)	(1)	(1)		(1).
Features favorable.	Features favorable.	Normally good surface drainage.	Features favorable.	Features favorable.	Features favorable.		C.
Sandstone at a depth of about 1 foot.	Limited quantity of borrow material; possibility of seepage.	Not needed; good natural drainage.	Moderately sloping topography; sandstone at a depth of about 1 foot.	Sandstone at a depth of about 1 foot.	Sandstone at a depth of about 1 foot; low water-holding capacity.		C.
Steep topography; other features favorable.	Features favorable.	Not needed; good natural drainage.	Steep topography.	Steep topography.	Steep topography.		D.
Features favorable.	Features favorable.	Not needed; good natural drainage.	Features favorable.	Features favorable.	Features favorable.		C.
High seepage potential.	Easily eroded; slopes need to be stabilized.	Not needed; excessive natural drainage.	Nonarable	Nonarable	Easily eroded; low fertility.		B.
Turbid water; other features favorable.	Subject to cracking; low shear strength.	Very slow internal drainage.	Very slow permeability; shallow surface layer; strongly alkaline subsoil.	Shallow surface layer over clay subsoil.	Unsuitable		D.
High seepage	Easily eroded; high seepage.	Not needed; excessive natural drainage.	Nearly level topography; low water-holding capacity.	Not needed; susceptible to wind erosion.	Easily eroded; low fertility.		A.
Sandstone at a depth of about 3 feet; possibility of seepage.	Possibility of seepage.	Not needed; good natural drainage.	Features favorable	Features favorable	Features favorable		B.

TABLE 9.—*Interpretation of*

Soil series and map symbols	Suitability as source of—			Soil features affecting engineering practices
	Topsoil	Select grading material	Road fill	Highway location
Hector-Hartsells (HhC):				
Hector	Poor: widely variable material; stony and rocky; bedrock at a depth of about 1 foot.	Unsuitable: stony	Poor to good: bedrock at a depth of about 1 foot.	Rough and rocky, broken topography.
Hartsells	Poor: easily eroded	Good	Good if slopes are stabilized.	Easily eroded
Hector (HtE)	Poor: stony and rocky; bedrock at a depth of about 1 foot.	Unsuitable: stony	Poor to good: bedrock at a depth of about 1 foot.	Rough and rocky, broken topography.
Konawa (KsD, KsD3)	Poor: easily eroded when used on steep slopes.	Good	Good if slopes are stabilized.	Gently rolling to strongly sloping topography; cuts easily eroded.
Lightning (Lg)	Poor	Unsuitable	Poor: high plasticity; unstable when wet.	Somewhat poor drainage; occasional flooding.
Mason (Ms)	Good	Surface layer fair; subsoil too clayey.	Fair: close control of moisture necessary; unstable when wet.	Nearly level topography
Ochlockonee (Oc)	Poor: easily eroded if used on steep slopes.	Good except for high water table.	Poor: high water table	Nearly level topography; high water table.
Oil-Waste land (Od)	(1)	(1)	(1)	(1)
Okemah (OkA, OkB)	Good to fair: subsoil is clay.	Unsuitable	Poor: high volume change; unstable when wet.	Unstable subsoil; slow internal drainage.
Okemah-Eram (OrB):				
Okemah	Fair: too clayey	Unsuitable	Poor: high volume change; unstable when wet.	Nearly level or gently sloping topography; slow internal drainage.
Eram	Fair: too clayey	Unsuitable	Poor: highly plastic; high volume change; unstable when wet.	Very slow internal drainage; high volume change.
Parsons (PaA, PaB)	Poor	Unsuitable	Poor: highly plastic; unstable when wet.	Seasonal perched water table; very slow internal drainage; unstable.

See footnote at end of table.

engineering properties of soils—Continued

Soil features affecting engineering practices—Continued							Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways		
Reservoir area	Embankment						
Sandstone at a depth of about 32 inches; possibility of seepage.	Stable; possibility of seepage.	Not needed; good natural drainage.	Gently sloping topography; moderate permeability.	Features favorable.	Features favorable.		B.
Bedrock at a depth of about 1 foot; steep topography.	Limited quantity of borrow material.	Not needed; excessive natural drainage.	Nonarable.	Nonarable.	Nonarable.		C.
Bedrock at a depth of about 1 foot; steep.	Limited quantity of borrow material.	Not needed; good natural drainage.	Nonarable.	Nonarable.	Nonarable.		C.
Possibility of seepage.	Easily eroded; slopes need to be stabilized.	Not needed; excessive natural drainage.	Sloping; moderate water-holding capacity.	Highly susceptible to wind erosion.	Easily eroded and gullied.		B.
Nearly level topography; features favorable.	Nearly level topography.	Depressions; slow internal drainage; occasional flooding.	Slow internal drainage; occasional flooding.	Not needed; nearly level topography.	Nearly level topography.		D.
Nearly level topography; features favorable.	Nearly level topography.	Not needed; good natural drainage.	Features favorable.	Not needed; nearly level topography.	Nearly level topography.		B.
High water table; nearly level topography.	Possibility of seepage; easily eroded.	Nearly level topography; high water table.	High water table.	Not needed; nearly level topography.	Nearly level topography; high water table.		B.
(1)	(1)	(1)	(1)	(1)	(1)		(1).
Features favorable.	Features favorable.	Surface drainage may be needed in level areas; slow internal drainage.	Features favorable.	Features favorable.	Features favorable.		C.
Features favorable.	Features favorable.	Surface drainage may be needed in level areas; slow internal drainage.	Nearly level or gently sloping topography; slow permeability.	Features favorable.	Features favorable.		D.
Features favorable.	Features favorable.	Not needed; good natural drainage.	Gently sloping; slow permeability.	Features favorable.	Features favorable.		D.
Features favorable.	High shrink-swell potential; unstable.	Depressions need drainage; very slow internal drainage; seasonal perched water table.	Very slow permeability.	Features favorable.	Features favorable.		D.

TABLE 9.—*Interpretation of*

Soil series and map symbols	Suitability as source of—			Soil features affecting engineering practices
	Topsoil	Select grading material	Road fill	Highway location
Roebuck (Rc)	Unsuitable	Unsuitable	Poor: highly plastic	Nearly level topography; frequent flooding; poor surface drainage and very slow internal drainage.
Smelter-waste land (Se)	([1])	([1])	([1])	([1])
Stidham (ShA)	Poor: easily eroded if used on steep slopes.	Good	Good if slopes are stabilized.	Features favorable
Strip Mines (Sm)	([1])	([1])	([1])	([1])
Taloka (TkA)	Surface material fair or good.	Poor: too elastic	Surface layer fair; close control of moisture necessary; subsoil poor; unstable when wet.	Seasonal perched water table; nearly level topography; very slow internal drainage; unstable.
Vanoss (VaA, VaB, VaC)	Good	Good or fair: normally too clayey below a depth of 1 foot.	Good	Features favorable
Verdigris (Vg)	Fair or good	Poor or fair	Uppermost layer fair; close control of moisture necessary; other layers unstable when wet.	Nearly level topography; occasional flooding.
Verdigris-Pulaski (Vp):				
Verdigris	Fair or good	Poor	Uppermost layer fair; close control of moisture necessary; other layers unstable when wet.	Nearly level topography; frequent flooding.
Pulaski	Fair	Fair	Fair or good: frequent flooding.	Frequent flooding
Woodson (WoA)	Poor or fair	Unsuitable	Poor: high shrink-swell potential; unstable when wet.	Nearly level topography; highly plastic; very slow internal drainage.
Wrightsville (Wr)	Fair or good	Poor or fair	Surface layer fair; close control of moisture necessary; subsoil unstable when wet.	Seasonal perched water table; nearly level topography; very slow internal drainage; unstable.

[1] No valid interpretations possible; onsite investigation necessary.

engineering properties of soils—Continued

Soil features affecting engineering practices—Continued							Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways		
Reservoir area	Embankment						
Nearly level topography.	High shrink-swell potential.	Poor surface drainage and very slow internal drainage; frequent flooding.	Frequent flooding; very slow permeability.	Nearly level topography; frequent flooding.	Nearly level topography; frequent flooding.		D.
(1)	(1)	(1)	(1)	(1)	(1)		(1).
Possibility of seepage.	Easily eroded; slopes need to be stabilized.	Not needed; good natural drainage.	Nearly level; moderate water-holding capacity.	Not needed; susceptible to wind erosion.	Easily eroded		B.
(1)	(1)	(1)	(1)	(1)	(1)		(1).
Features favorable.	Subsoil has high shrink-swell potential; high fills unstable.	Very slow internal drainage.	Features favorable.	Features favorable.	Features favorable.		D.
Possibility of seepage below a depth of 4 feet.	Features favorable.	Not needed; good natural drainage.	Features favorable.	Features favorable.	Features favorable.		B.
Features favorable.	Features favorable.	Not needed; good natural drainage; occasional flooding.	Occasional flooding; other features favorable.	Not needed; occasional flooding; nearly level topography.	Occasional flooding; nearly level topography.		B.
Nearly level topography; frequent flooding.	Good stability	Not needed; good natural drainage; frequent flooding.	Frequent flooding; nearly level topography; high water-holding capacity.	Frequent flooding; nearly level topography.	Frequent flooding; nearly level topography.		B.
Frequent flooding; nearly level topography.	Variable material; frequent flooding.	Frequent flooding.	Frequent flooding.	Frequent flooding; nearly level topography.	Frequent flooding; nearly level topography.		
Features favorable.	Highly plastic; high fills unstable.	Nearly level topography; very slow permeability.	Nearly level topography; very slow permeability.	Nearly level topography; other features favorable.	Features favorable.		D.
Features favorable.	Subsoil has high shrink-swell potential; high fills unstable.	Very slow internal drainage; seasonal perched water table.	Very slow permeability; nearly level topography.	Nearly level topography.	Nearly level topography.		D.

TABLE 10.—*Engineering*

[Tests performed by the Oklahoma Department of Highways in accordance with standard

Soil name and location	Parent material	Oklahoma report number	Depth from surface	Horizon	Shrinkage	
					Limit	Ratio
			In.		*Pct.*	
Eram clay loam (modal): NE¼NW¼ sec. 4, T. 14 N., R. 14 E.	Shale and clay beds with thin beds of limestone in places.	SO–5175	0 to 8	A1	20	1. 74
		SO–5176	16 to 24	BC	11	2. 03
Okemah silt loam (modal): 1,000 feet S. of NE. corner, sec. 4, T. 14 N., R. 14 E.	Shale, siltstone, and clay beds.	SO–5177	0 to 14	A1	23	1. 61
		SO–5178	20 to 28	B2	11	1. 97
Roebuck clay (modal): 1,000 feet W. and 200 feet N. of SE. corner, sec. 21, T. 13 N., R. 13 E.	Alluvium.	SO–5168	0 to 15	A	18	1. 76
		SO–5169	15 to 30	C	13	1. 90

[1] According to Designation: T 88–57, "Mechanical Analysis of Soils," in "Standard Specifications for Highway Materials and Methods of Sampling and Testing," pt. 2, Ed. 8 (1961), published by AASHO. Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than

The effects of the factors of soil genesis are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent material

Some of the soils in Okmulgee County formed in material weathered from sandstone, shale, and limestone, some in old alluvium, and some in recent alluvium. The sandstone, which is resistant to weathering, makes up the ridges, and the shale and limestone, which are finer grained than the sandstone and weather more rapidly, make up the broad valleys. Deposits of old alluvium make up the high terraces, which are mostly along the Deep Fork Canadian River, and deposits of recent alluvium occur on flood plains.

The soils that formed in material weathered from sandstone are generally shallow to moderately deep and in places are stony. Examples are Bates, Collinsville, Hector, and Hartsells soils. The soils that formed in material weathered from shale and limestone are generally deeper. Examples are Dennis, Eram, and Okemah soils. Soils that formed in old alluvium are deep because the sediments have been in place long enough for a profile to develop. Examples are Konawa, Stidham, and Vanoss soils. Soils that formed in recent alluvium vary in texture and show little or no evidence of profile development. Examples are Pulaski and Verdigris soils.

Climate

Climate affects soil formation through its influence on vegetation, on weathering, and on runoff and erosion.

The climate of Okmulgee County has been favorable for soil development. Both rainfall and temperature have been such as to encourage the growth of trees and tall grasses. Enough water has percolated through the soils to cause the downward movement of fine particles, colloids, and soluble minerals. Consequently, most of the soils are acid, and many, including those of the Dennis, Parsons, and Taloka series, have accumulations of clay in the subsoil.

Living organisms

As living organisms, both plants and animals, die and decay, they affect soil formation by returning minerals and organic matter to the soil.

The vegetation in Okmulgee County consists of tall grasses (prairie vegetation) and trees.

The most important tall grasses in the original prairie vegetation were big bluestem, little bluestem, indiangrass, and switchgrass. The soils that developed under this vegetation have a thick, dark-colored surface layer that is relatively high in organic-matter content. Examples are Dennis, Bates, and Taloka soils.

The original forests consisted of deciduous trees. The soils that developed under this vegetation have a thin, light-colored surface layer that is leached of soluble materials. Examples are the moderately deep Hartsells soils, which formed on ridges under blackjack oak, post oak, and hickory, and the deep Konawa and Stidham soils, which formed under oak trees on the sandy parts of the old alluvial terraces. The recent alluvium on the flood plains has not been in place long enough for vegetation to have had much influence. Trees live longer than grasses and decay less rapidly; consequently, soils that formed under trees are lower in organic-matter content, less fertile, and more acid than soils that formed under grasses.

Earthworms and micro-organisms are numerous where organic matter is abundant, the moisture supply is adequate, and the temperature mild. These organisms digest

test data

procedures of the American Association of State Highway Officials (AASHO)]

Volume change from field moisture equivalent	Mechanical analysis [1]						Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—			Percentage smaller than—						
	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			AASHO	Unified [2]
29	100	93	83	68	28	23	39	12	A-6(9)	ML-CL.
64	100	97	91	82	53	46	57	24	A-7-5(17)	MH.
25	100	97	93	87	27	20	38	9	A-4(8)	ML.
80	100	99	97	90	56	49	63	32	A-7-5(20)	MH-CH.
55	----------	100	99	95	54	42	56	23	A-7-5(16)	MH.
41	100	99	91	83	45	36	42	20	A-7-6(12)	CL.

2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[2] SCS and BPR have agreed to consider that all soils having plasticity indexes within 2 points of A-line are to be given a borderline classification. Examples of borderline classifications by this use are ML-CL and MH CH.

the organic materials that help to develop soil structure and nourish plants.

Relief

The length, shape, steepness, and pattern of slopes influence soil formation through their effect on drainage, runoff, and erosion.

The relief in Okmulgee County ranges from nearly level to steep. Very gentle slopes predominate. Very gently sloping soils of the Choteau and Dennis series generally have adequate surface drainage and are only slightly eroded. They have a thick or moderately thick surface layer and a subsoil that is clayey but not dense. Nearly level soils, such as Parsons and Dwight, have slow surface drainage. They have a thinner surface layer than gently sloping soils, and they have a dense subsoil. Because of rapid runoff and the resulting erosion, the steeper soils are shallow or very shallow and show little evidence of profile development.

Time

Time is required for the weathering of rock to parent material, the transformation of parent material into soil, the percolation of water through the soil, and the growth of vegetation. In Okmulgee County these processes have been active long enough for most soils that have slopes of 5 percent or less to have well-developed profile characteristics. Examples are Dennis and Okemah soils. Most of the soils that have slopes of more than 5 percent are shallow and lack a well-developed profile. Examples are Collinsville and Talihina soils.

Classification and Morphology of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is also useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 [10] and revised later.[11] The system currently used by the National Cooperative Soil Survey was adopted in 1965. The current system is under continual study. Readers interested in the development of the system should refer to the latest literature available.[12 13]

This current system consists of six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are measurable or observable, but the properties are selected so that soils of similar genesis are grouped together. Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

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[10] BALDWIN, MARK, KELLOGG, CHARLES E., and THORP, JAMES. SOIL CLASSIFICATION. U.S. Dept. Agr. Ybk. 1938.

[11] THORP, JAMES, and SMITH, GUY D. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUP. Soil Sci. 67: 117-126. 1949.

[12] SIMONSON, ROY W. SOIL CLASSIFICATION IN THE UNITED STATES. Science, v. 137, No. 3535, pp. 1027-1034, illus. 1962.

[13] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. 265 pp., illus. 1960. [Supplement issued in March 1967]

Table 11 shows the classification of the soil series of Okmulgee County according to the current system. The categories of the current system are defined briefly in the following paragraphs.

ORDER: In the order, soils are grouped according to properties that seem to result from the same processes acting to about the same degree on soil material. Ten soil orders are recognized in the current system: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. Entisols, Inceptisols, Mollisols, Alfisols, and Ultisols are represented in Okmulgee County.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. A suborder has a narrower climatic range than an order. The criteria for suborders reflect either (1) the presence or absence of waterlogging or (2) differences in climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons.

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) concept of the group, and others, called intergrades, representing the soils that have mostly the properties of one great group but also have one or more properties of the soils of another great group, suborder, or order.

FAMILIES: Each subgroup is divided into families, primarily on the basis of properties important to plant growth. Some of the properties considered are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons.

TABLE. 11—*Soil series in Okmulgee County classified into higher categories*

Series	Current classification		
	Family	Subgroup	Order
Bates	Fine loamy, mixed, thermic	Typic Argiudolls	Mollisols.
Choteau	Fine silty mixed, thermic	Typic Paleudolls	Mollisols.
Collinsville	Loamy, mixed, thermic	Lithic Hapludolls	Mollisols.
Dennis	Fine, mixed, thermic	Typic Paleudolls	Mollisols.
Dougherty	Loamy, siliceous, thermic	Arenic Haplustalfs	Alfisols.
Dwight	Fine, mixed, thermic	Typic Natrustolls	Mollisols.
Eram	Fine, mixed, thermic	Vertic Argiudolls	Mollisols.
Eufaula	Sandy, siliceous, thermic	Psammentic Haplustalfs	Alfisols.
Hartsells	Fine loamy, mixed thermic	Typic Hapludults	Ultisols.
Hector	Loamy, siliceous, thermic	Lithic Dystrochrepts	Inceptisols.
Konawa	Fine loamy, mixed, thermic	Ultic Haplustalfs	Alfisols.
Lightning	Fine, mixed, thermic	Typic Ochraqualfs	Alfisols.
Mason	Fine silty, mixed, thermic	Typic Argiudolls	Mollisols.
Ochlockonee	Coarse loamy, siliceous, acid, thermic	Typic Udifluvents	Entisols.
Okemah	Fine, mixed, thermic	Aquic Paleudolls	Mollisols.
Parsons	Fine, mixed, thermic	Udollic Albaqualfs	Alfisols.
Pulaski	Coarse loamy, siliceous, nonacid, thermic	Typic Ustifluvents	Entisols.
Roebuck	Fine, mixed, thermic	Vertic Hapludolls	Mollisols.
Stidham	Loamy, siliceous, thermic	Arenic Haplustalfs	Alfisols.
Talihina	Fine, mixed, thermic, shallow	Typic Hapludolls	Mollisols.
Taloka	Fine, mixed, thermic	Udollic Albaqualfs	Alfisols.
Vanoss	Fine silty, mixed, thermic	Udic Argiustolls	Mollisols
Verdigris	Fine silty, mixed, thermic	Cumulic Hapludolls	Mollisols.
Woodson	Fine, mixed, thermic	Vertic Argiaquolls	Mollisols.
Wrightsville	Fine, mixed, thermic	Typic Glossaqualfs	Alfisols.

Glossary

Acidity. See Reaction, soil.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors, consisting of concentrations of compounds or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

Loess. A fine-grained eolian deposit consisting dominantly of silt-sized particles.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Permeability. The quality that enables a soil horizon to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system, made because of differences that affect management but do not affect classification. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. As a soil separate, individual rock or mineral fragments ranging from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Saturated soil. A soil filled to its capacity with water.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Water-holding capacity. The amount of moisture held in a soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Water table, perched. The upper surface of a body of free ground water that is separated from an underlying body of ground water by unsaturated material.

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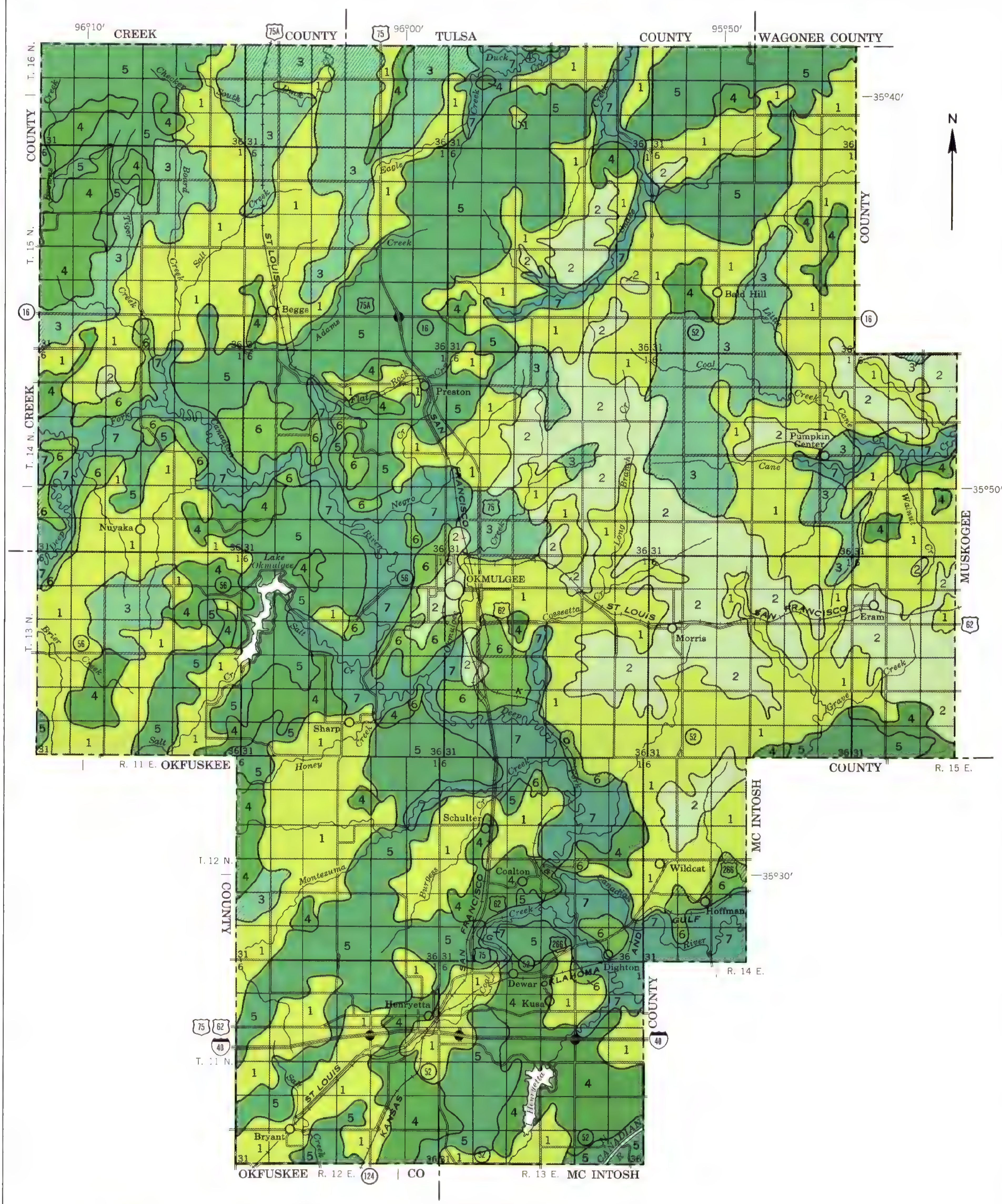
All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).



SOIL ASSOCIATIONS

- 1 — Dennis-Bates-Parsons association: Nearly level or gently sloping, deep or moderately deep soils on prairie uplands
- 2 — Taloka association: Nearly level, deep soils that have a thick surface layer, on prairie uplands
- 3 — Okemah-Woodson association: Nearly level or very gently sloping, deep, dark-colored soils on prairie uplands
- 4 — Collinsville-Talihina association: Strongly sloping to steep, shallow, stony soils on prairie uplands
- 5 — Hector-Hartsells association: Very gently sloping to steep, shallow to moderately deep soils on forested uplands
- 6 — Konawa-Stidham association: Nearly level to sloping, deep, light-colored, sandy soils on upland stream terraces
- 7 — Verdigris-Lightning-Pulaski association: Nearly level, deep, loamy soils on flood plains

January 1967

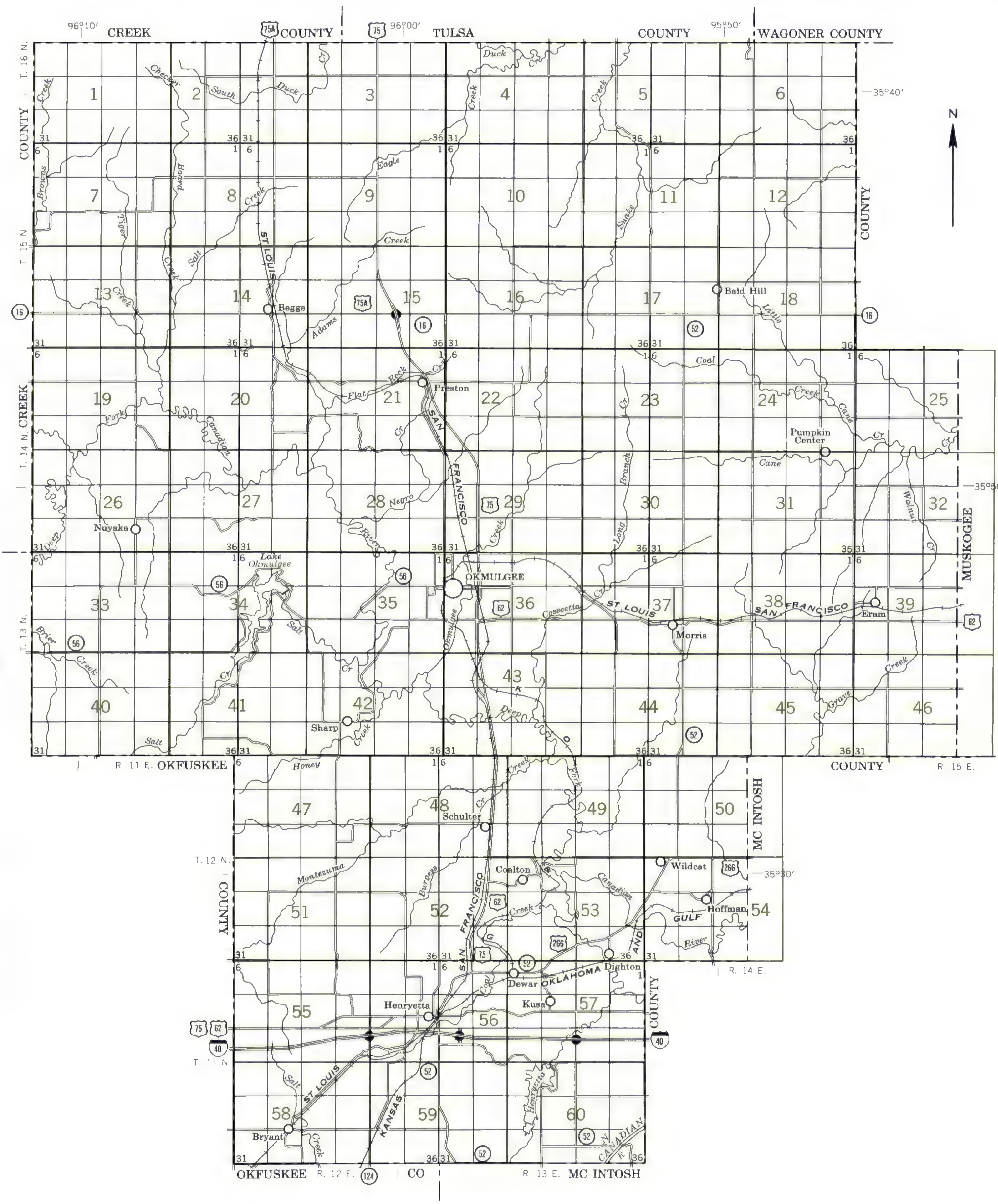
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
OKMULGEE COUNTY, OKLAHOMA

SCALE IN MILES

1 0 1 2 3 4



INDEX TO MAP SHEETS
OKMULGEE COUNTY, OKLAHOMA

SCALE IN MILES

1 0 1 2 3 4

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those of soils for and types that are nearly level, but some are for soils or land types that have a considerable range in slope. A final number, 2 or 3, in the symbol shows that the soil is eroded or severely eroded.

SYMBOL	NAME
BaB	Bates loam, 1 to 3 percent slopes
Ba[illegible]	Bates loam, 3 to 5 percent slope
Bc	Bates–Collinsville fine sandy loams, 1 to 5 percent slopes
Bk	Breaks–alluvial land complex
B[illegible]	Broken alluvial land
ChB	Choteau loam, 1 to 3 percent slopes
CtE	Collinsville–Talihina complex, 10 to 30 percent slopes
DeB	Dennis silt loam, 1 to 3 percent slopes
De[illegible]	Dennis silt loam, 3 to 5 percent slopes
De[illegible]2	Dennis silt loam, 2 to 5 percent slopes, eroded
D[illegible]3	Dennis soils, 2 to 6 percent slopes, severely eroded
D[illegible]	Dougherty Eufaula complex, rolling
DwA	Dwight-Parsons silt loams, 0 to 1 percent slope
E[illegible]B	Eufaula fine sand, undulating
HaB	Hartsells fine sandy loam, 1 to 3 percent slopes
H[illegible]	Hector Hartsells fine sandy loams, 1 to 5 percent slopes
H[illegible]E	Hector complex, 5 to 30 percent slopes
K[illegible]	Konawa loamy fine sand, 3 to 8 percent slopes
K[illegible]	Konawa loamy fine sand, 3 to 8 percent slopes, severely eroded
L[illegible]	Lightning silt loam
M[illegible]	Mason loam
O[illegible]	Ochlockonee soils, wet
Od	Oil – Waste land
OkA	Okemah silt loam, 0 to 1 percent slopes
OkB	Okemah silt loam, 1 to 3 percent slopes
OrB	Okemah Eram clay loams, 1 to 3 percent slope
PaA	Parsons silt loam, 0 to 1 percent slopes
PaB	Parsons silt loam, 1 to 3 percent slopes
R[illegible]	Roebuck clay
S[illegible]	Smelter-waste land
ShA	Stidham loamy fine sand, 0 to 2 percent slope
Sm	Strip Mines
TkA	Taloka silt loam, 0 to 2 percent slopes
VaA	Vanoss loam, 0 to 1 percent slopes
VaB	Vanoss loam, 1 to 3 percent slopes
Va[illegible]	Vanoss loam, 3 to 5 percent slopes
V[illegible]	Verdigris silt loam
V[illegible]p	Verdigris-Pulaski soils, frequently flooded
WoA	Woodson silty clay loam, 0 to 1 percent slopes
Wr	Wrightsville loam, thick surface

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferry — FY
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries

Mine dump

Pits, gravel or other

Power line

Pipe line

Cemetery

Dams

Levee

Tanks

Well, oil or gas

BOUNDARIES

- National or state
- County
- Township or range, U. S.
- Section line, corner, U. S.
- Reservation
- Land grant
- Small park, cemetery, airport

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
- Crossable with tillage implements
- Not crossable with tillage implements
- Unclassified

Canals and ditches — CANAL

Lakes and ponds
- Perennial — water, w
- Intermittent

Wells, water — flowing

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

Depressions — Large, Small
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stony, very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

Soil map constructed 1966 by Cartographic Division, Soil Conservation Service, USDA, from 1963 aerial photographs. Controlled mosaic based on Oklahoma plane coordinate system, north zone, Lambert conformal conic projection, 1927 North American datum.

GUIDE TO MAPPING UNITS

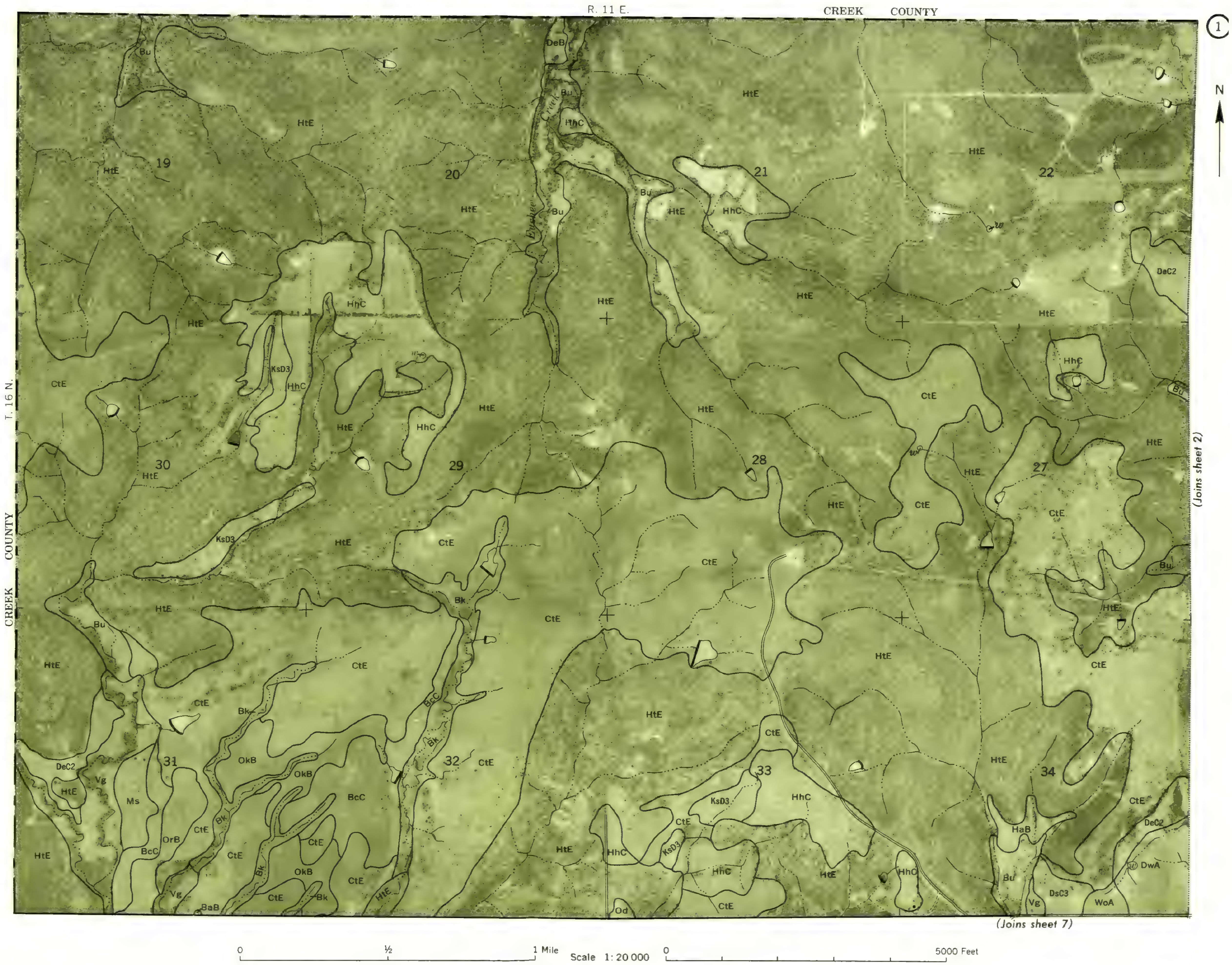
[For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs.

[See table 6, page 10, for approximate acreage and proportionate extent of the soils and table 7, page 30, for estimated yields per acre of the principal crops. For facts about the engineering properties of the soils, turn to the section beginning on page 36]

Map symbol	Mapping unit	Described on page	Capability unit		Range site		Post-lot and windbreak suitability group	
			Symbol	Page	Name	Page	Number	Page
BaB	Bates loam, 1 to 3 percent slopes	10	IIe-1	26	Loamy Prairie	32	III	35
BaC	Bates loam, 3 to 5 percent slopes	10	IIIe-1	27	Loamy Prairie	32	III	35
BcC	Bates-Collinsville fine sandy loams, 1 to 5 percent slopes	10						
	Bates soil	--	IVe-1	28	Loamy Prairie	32	III	35
	Collinsville soil	--	IVe-1	28	Shallow Prairie	33	III	35
Bk	Breaks-alluvial land complex	11						
	Breaks	--	VIe-4	29	Loamy Prairie	32	III	35
	Alluvial land	--	VIe-4	29	Loamy Bottomland	34	III	35
Bu	Broken alluvial land	11	Vw-4	29	Loamy Bottomland	34	I	35
ChB	Choteau loam, 1 to 3 percent slopes	11	IIe-1	26	Loamy Prairie	32	II	35
CtE	Collinsville-Talihina complex, 10 to 30 percent slopes	12	VIIs-1	29	Shallow Prairie	33	IV	36
DeB	Dennis silt loam, 1 to 3 percent slopes	12	IIe-2	26	Loamy Prairie	32	II	35
DeC	Dennis silt loam, 3 to 5 percent slopes	12	IIIe-1	27	Loamy Prairie	32	II	35
DeC2	Dennis silt loam, 2 to 5 percent slopes, eroded	12	IIIe-2	27	Loamy Prairie	32	III	35
DsC3	Dennis soils, 2 to 6 percent slopes, severely eroded	12	VIe-1	29	Eroded Prairie	33	IV	36
Dt	Dougherty-Eufaula complex, rolling	13	VIe-3	29	Deep Sand Savannah	33	II	35
DwA	Dwight-Parsons silt loams, 0 to 1 percent slopes	14						
	Dwight soil	--	IVs-1	28	Shallow Claypan	33	IV	36
	Parsons soil	--	IVs-1	28	Claypan Prairie	33	IV	36
EuB	Eufaula fine sand, undulating	14	IVs-2	28	Deep Sand Savannah	33	II	35
HaB	Hartsells fine sandy loam, 1 to 3 percent slopes	15	IIe-3	26	Sandy Savannah	34	II	35
HhC	Hector-Hartsells fine sandy loams, 1 to 5 percent slopes	16						
	Hector soil	--	IVe-2	28	Shallow Savannah	34	III	35
	Hartsells soil	--	IVe-2	28	Sandy Savannah	34	III	35
HtE	Hector complex, 5 to 30 percent slopes	16	VIIs-2	29	Shallow Savannah	34	IV	36
KsD	Konawa loamy fine sand, 3 to 8 percent slopes	16	IVe-3	28	Deep Sand Savannah	33	II	35
KsD3	Konawa loamy fine sand, 3 to 8 percent slopes, severely eroded	16	VIe-2	29	Deep Sand Savannah	33	III	35
Lg	Lightning silt loam	17	IIIw-1	28	Heavy Bottomland	34	III	35
Ms	Mason loam	17	I-1	26	Loamy Bottomland	34	I	35
Oc	Ochlockonee soils, wet	18	Vw-1	29	Subirrigated	34	II	35
Od	Oil-Waste land	18	VIIIs-1	30	(1/)	--	IV	36
OkA	Okemah silt loam, 0 to 1 percent slopes	19	I-2	26	Loamy Prairie	32	II	35
OkB	Okemah silt loam, 1 to 3 percent slopes	19	IIe-2	26	Loamy Prairie	32	II	35
OrB	Okemah-Eram clay loams, 1 to 3 percent slopes	19	IIIe-5	27	Loamy Prairie	32	III	35
PaA	Parsons silt loam, 0 to 1 percent slopes	19	IIs-1	26	Claypan Prairie	33	III	35
PaB	Parsons silt loam, 1 to 3 percent slopes	19	IIIe-3	27	Claypan Prairie	33	III	35
Rc	Roebuck clay	21	Vw-2	29	Heavy Bottomland	34	III	35
Se	Smelter-waste land	21	VIIIs-1	30	(1/)	--	IV	36
ShA	Stidham loamy fine sand, 0 to 2 percent slopes	21	IIIe-4	27	Deep Sand Savannah	33	II	35
Sm	Strip Mines	21	VIIe-1	29	(1/)	--	III	35
TkA	Taloka silt loam, 0 to 2 percent slopes	22	IIs-2	27	Loamy Prairie	32	II	35
VaA	Vanoss loam, 0 to 1 percent slopes	22	I-2	26	Loamy Prairie	32	I	35
VaB	Vanoss loam, 1 to 3 percent slopes	23	IIe-1	26	Loamy Prairie	32	I	35
VaC	Vanoss loam, 3 to 5 percent slopes	23	IIIe-1	27	Loamy Prairie	32	II	35
Vg	Verdigris silt loam	23	IIw-1	26	Loamy Bottomland	34	I	35
Vp	Verdigris-Pulaski soils, frequently flooded	23	Vw-3	29	Loamy Bottomland	34	I	35
WoA	Woodson silty clay loam, 0 to 1 percent slopes	24	IIs-1	26	Claypan Prairie	33	IV	36
Wr	Wrightsville loam, thick surface	24	IIIw-2	28	Loamy Prairie	32	II	35

1/ Not placed in a range site.

OKMULGEE COUNTY, OKLAHOMA — SHEET NUMBER 1



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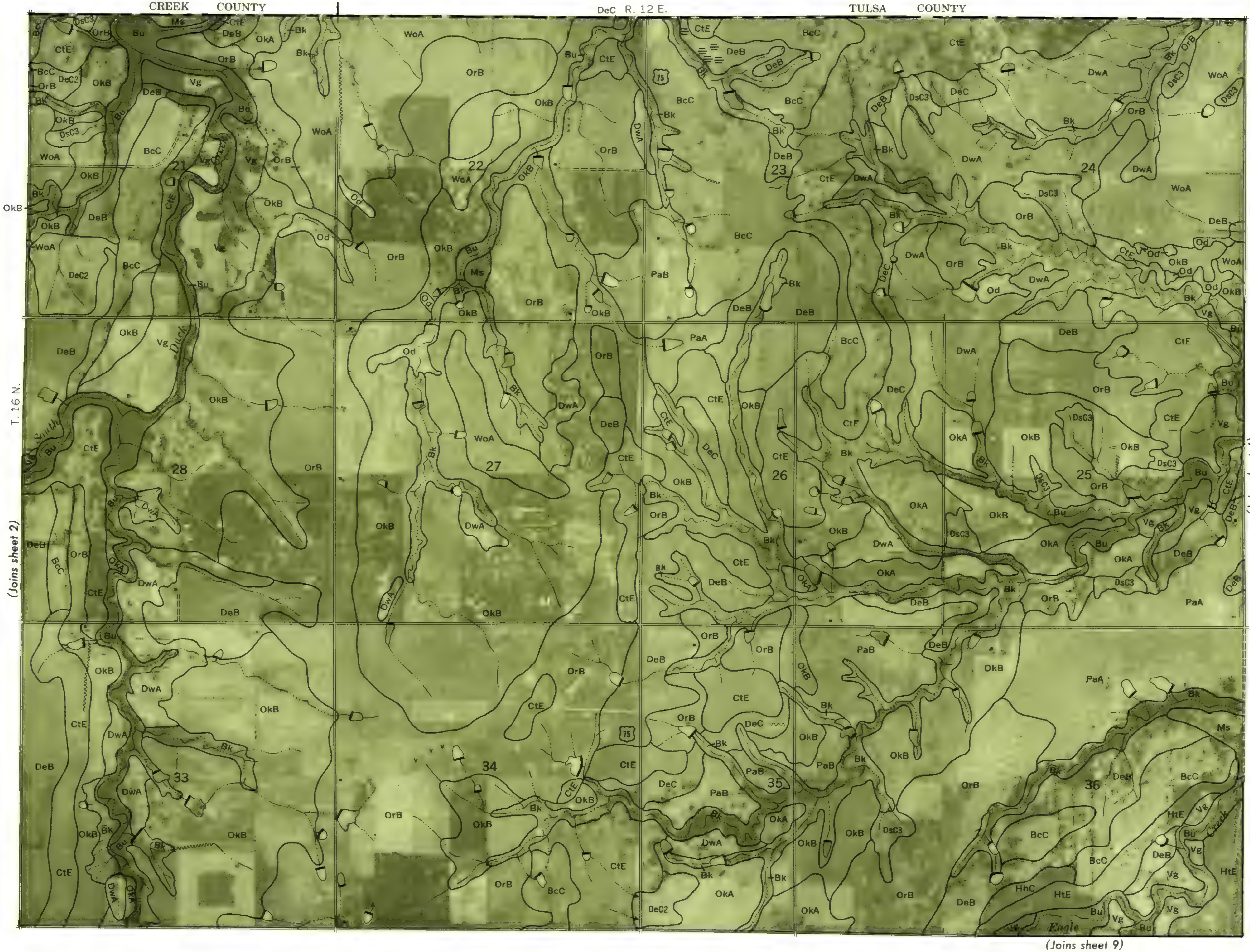
OKMULGEE COUNTY, OKLAHOMA NO. 1

2

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

OKMULGEE COUNTY, OKLAHOMA — SHEET NUMBER 3



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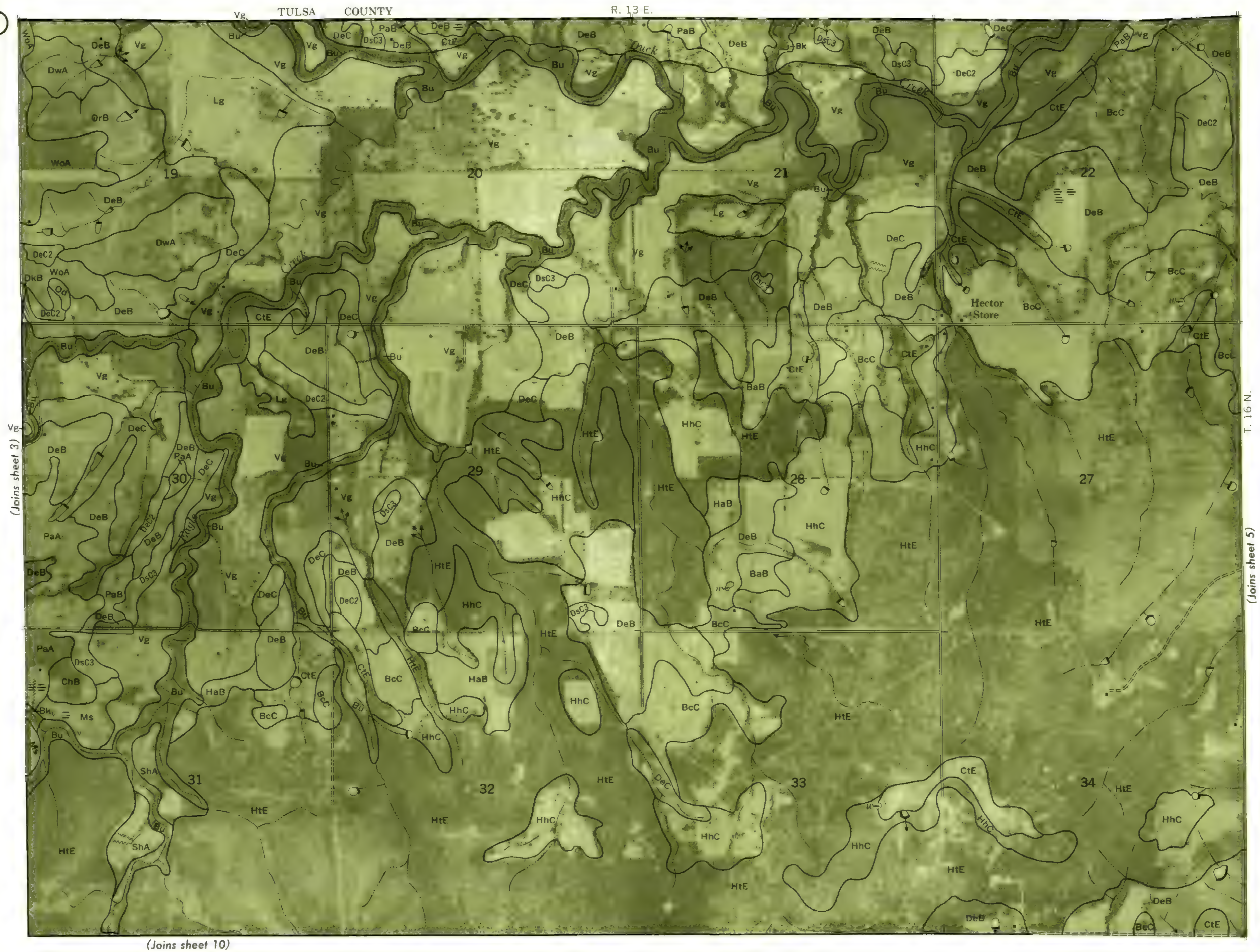
4



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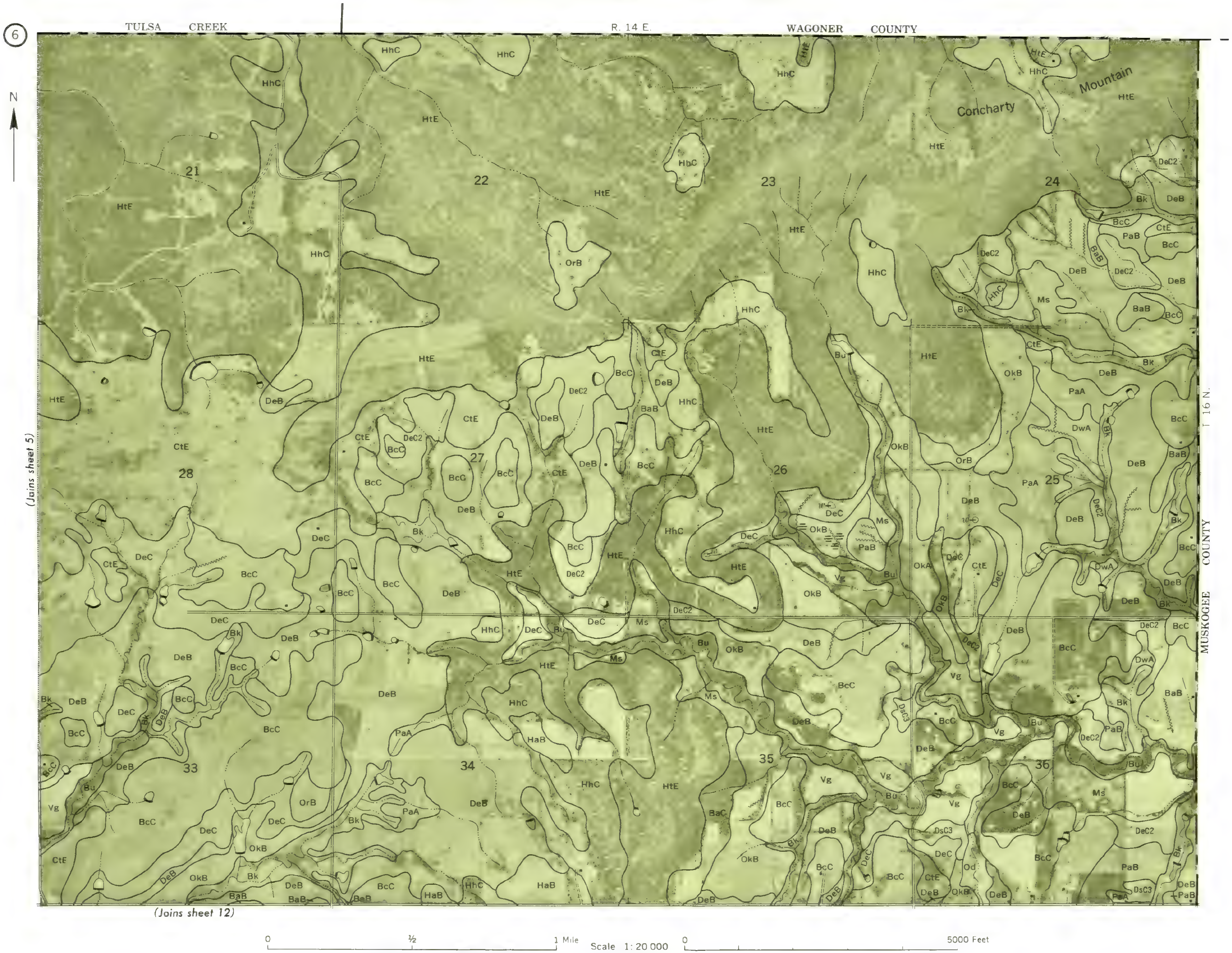
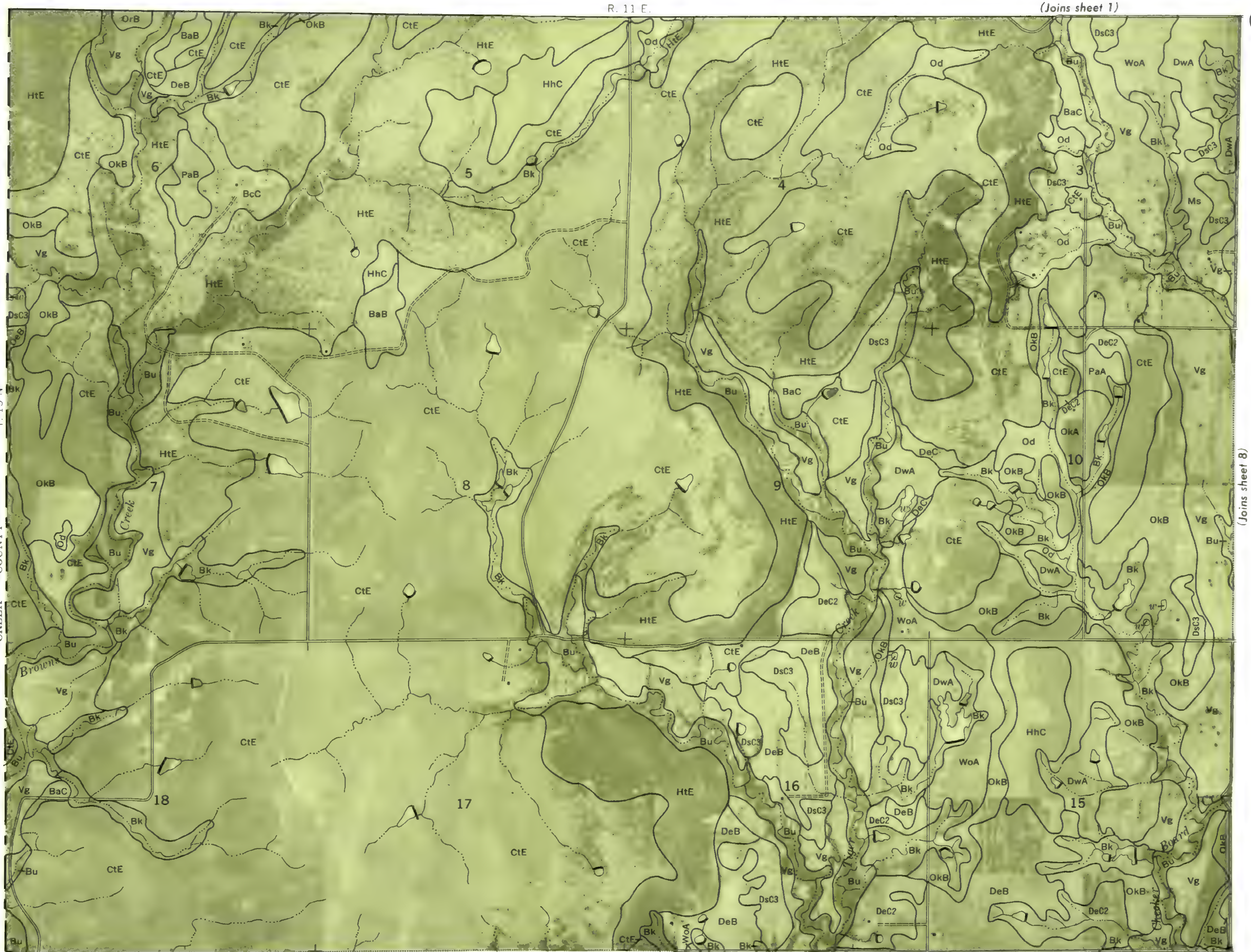
OKMULGEE COUNTY, OKLAHOMA NO. 5


6
TULSA CREEK
R. 14 E.
WAGONER COUNTY
N
Concharty Mountain
21
22
23
24
25
26
27
28
33
34
35
36
T. 16 N.
MUSKOGEE COUNTY
(Joins sheet 5)
(Joins sheet 12)
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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OKMULGEE COUNTY, OKLAHOMA NO. 7


8
(Joins sheet 2)
R. 11 E.
R. 12 E.
N
(Joins sheet 7)
(Joins sheet 9)
T. 15 N.
Mayflower School
Creek
ST LOUIS SAN FRANCISCO
(Joins sheet 14)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

OKMULGEE COUNTY, OKLAHOMA — SHEET NUMBER 9

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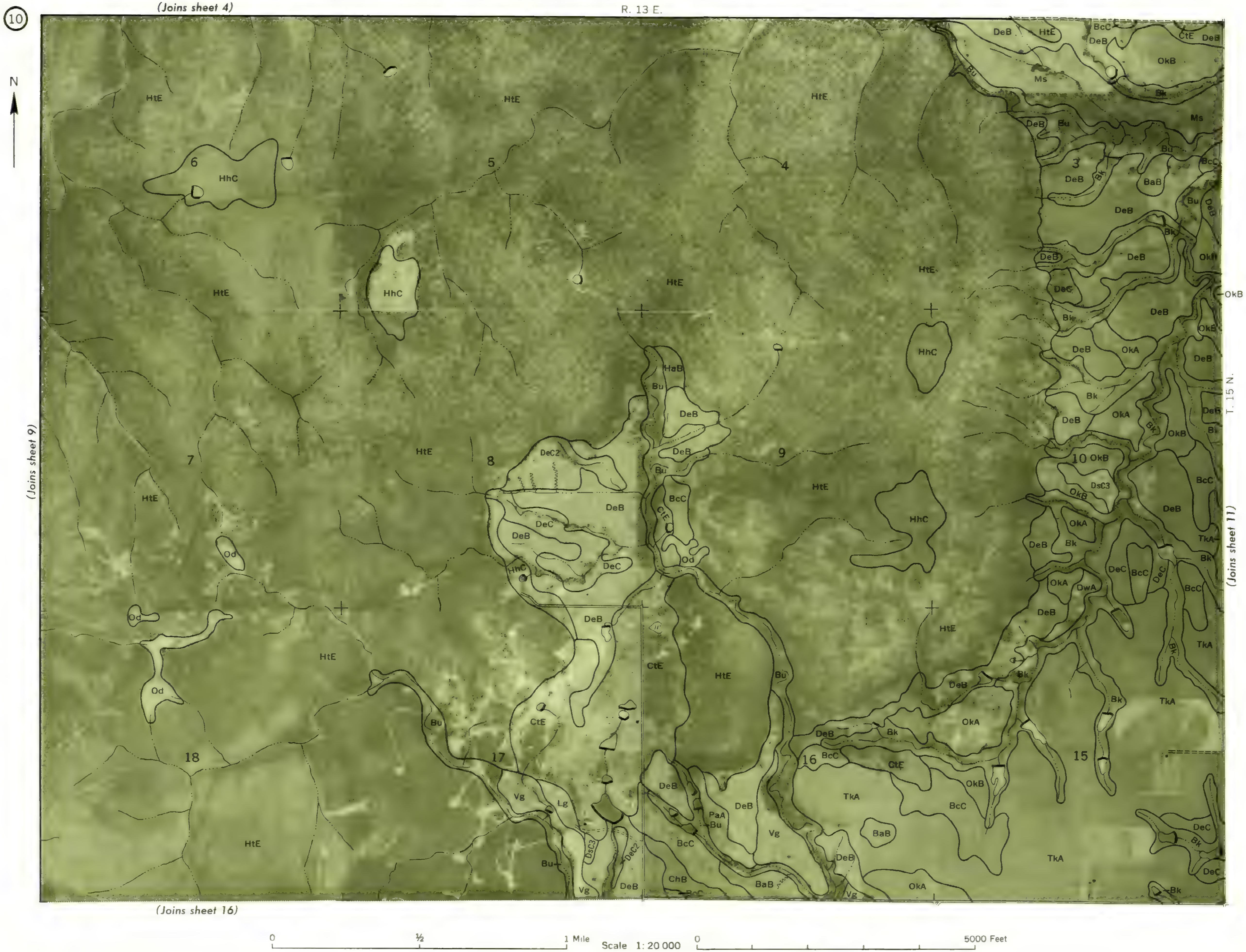
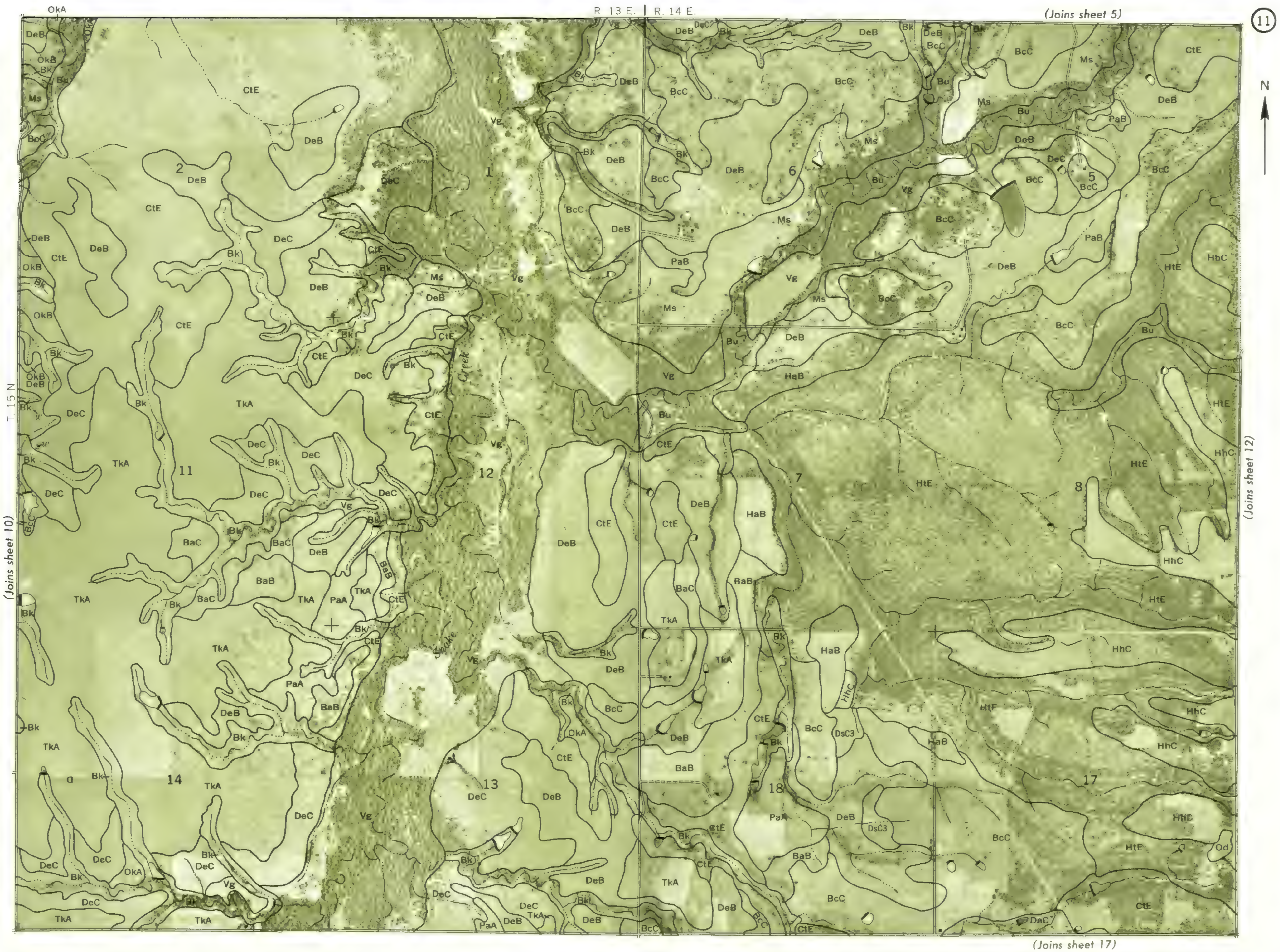
OKMULGEE COUNTY, OKLAHOMA NO. 9

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet


10
(Joins sheet 4)
R. 13 E.
N
(Joins sheet 9)
(Joins sheet 11)
T. 15 N.
(Joins sheet 16)
3
4
5
6
7
8
9
10
15
16
17
18
HtE
HhC
Od
DeB
DeC
DeC2
BcC
CtE
HaB
Bu
Vg
Lg
DsC3
ChB
PaA
BaB
TkA
OkA
OkB
Bk
Ms
DwA
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet



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OKMULGEE COUNTY, OKLAHOMA NO. 11

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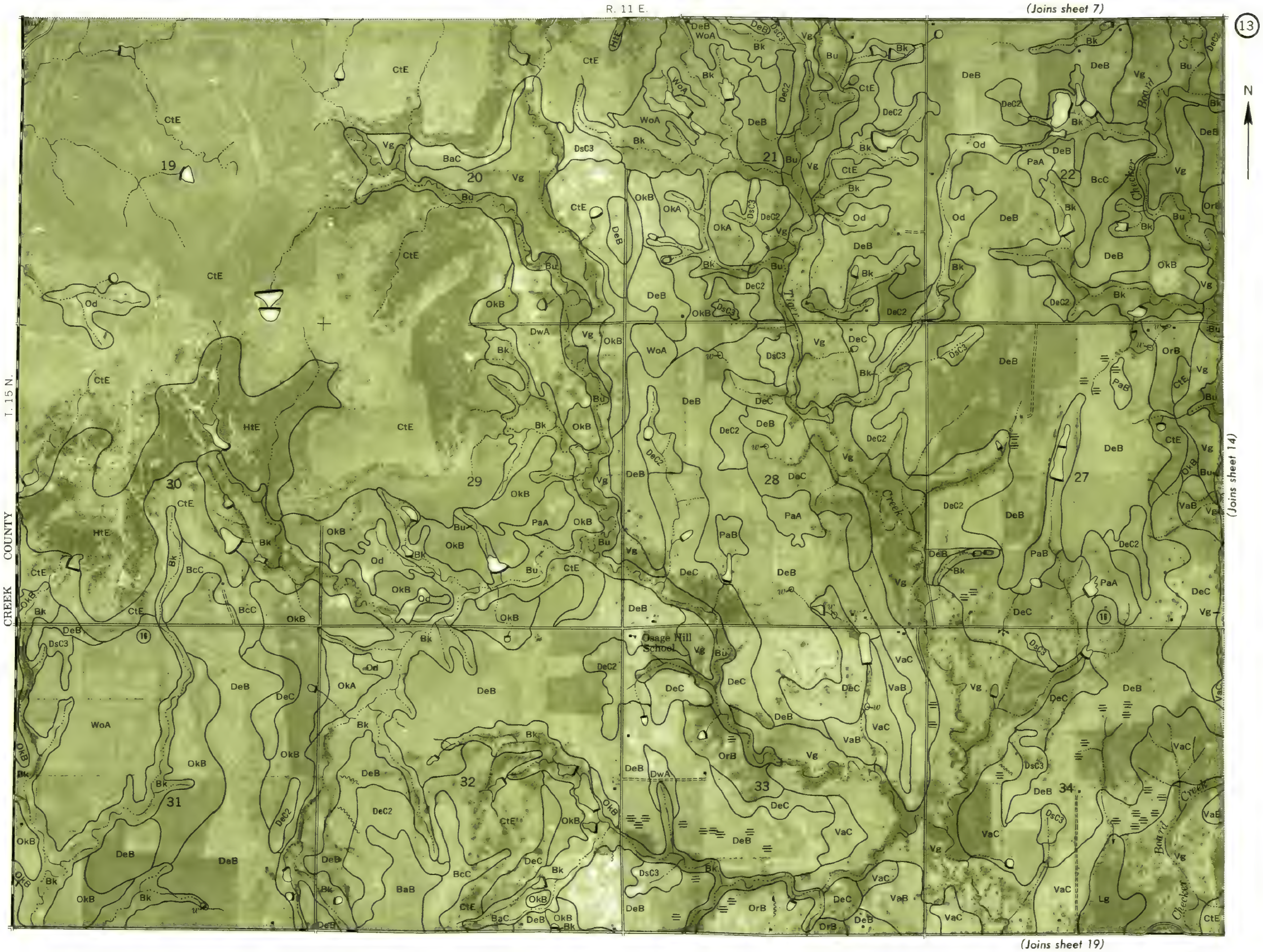
12
(Joins sheet 6)
R. 14 E
N
(Joins sheet 11)
T. 15 N.
MUSKOGEE COUNTY
Lone Star School
(Joins sheet 18)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet



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OKMULGEE COUNTY, OKLAHOMA NO. 13

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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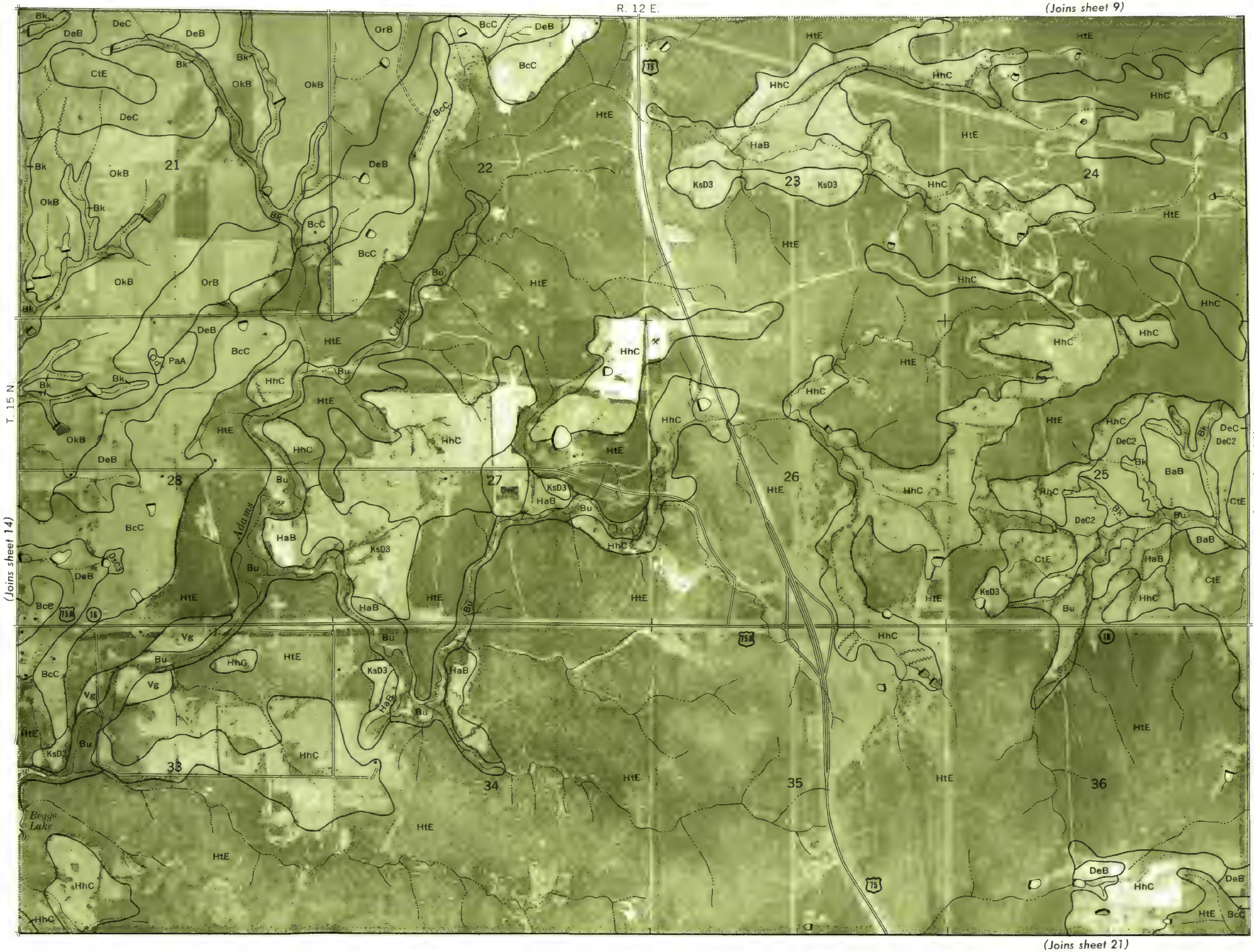
OKMULGEE COUNTY, OKLAHOMA NO. 15

15



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

16

(Joins sheet 10)

R. 13 E.

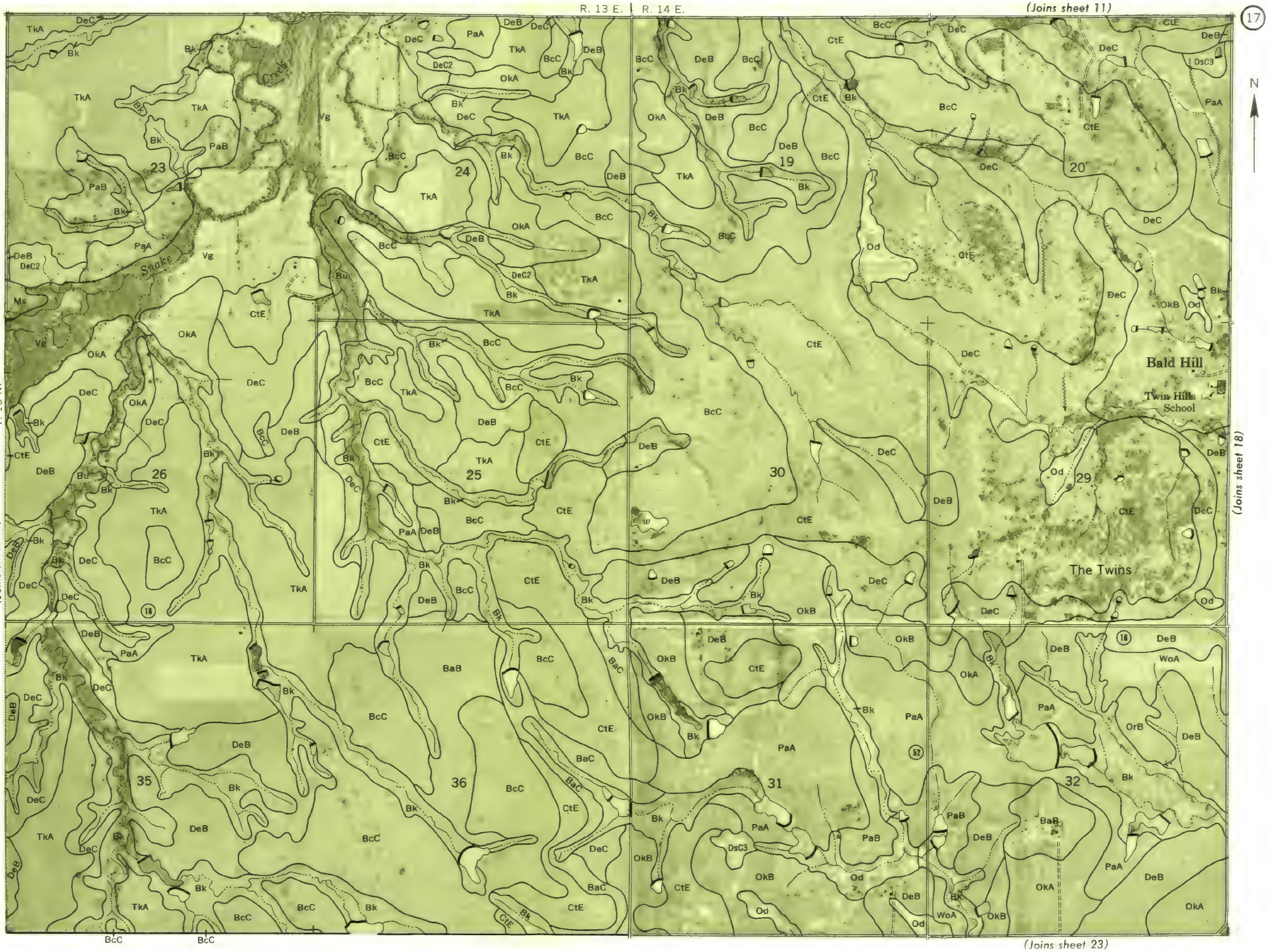
(Joins sheet 15)

T. 15 N.

(Joins sheet 17)

(Joins sheet 22)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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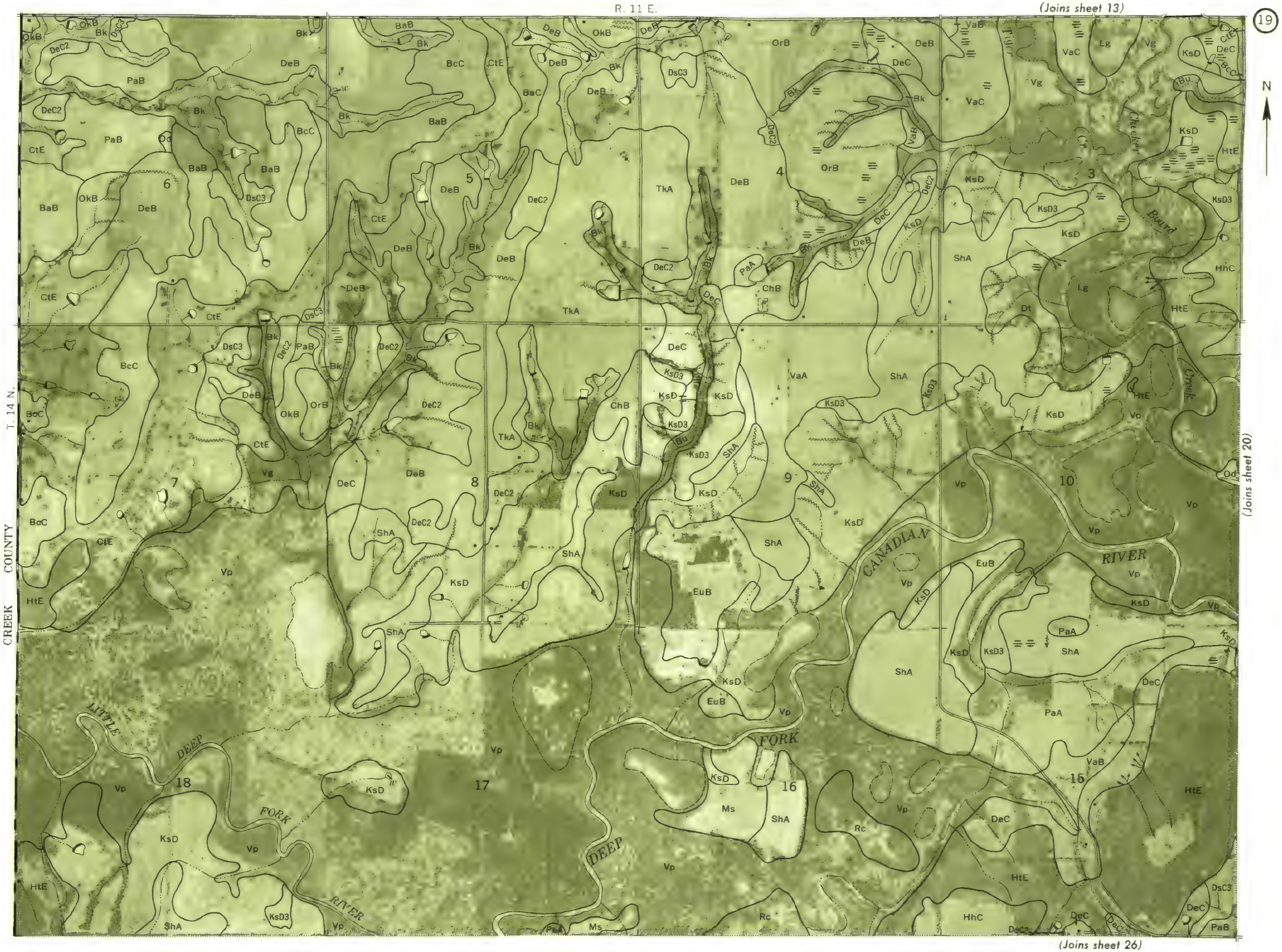
OKMULGEE COUNTY, OKLAHOMA — SHEET NUMBER 18

OKMULGEE COUNTY, OKLAHOMA NO. 18



Scale 1: 20 000

0 ½ 1 Mile

0 5000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.
Range, township, and section corners shown on this map are indefinite.

OKMULGEE COUNTY, OKLAHOMA NO 19


20
(Joins sheet 14)
R. 11 E. | R. 12 E.
N
(Joins sheet 19)
(Joins sheet 21)
T. 14 N.
(Joins sheet 27)
DEEP FORK CANADIAN RIVER
Adams Creek
ST. L. — SF
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

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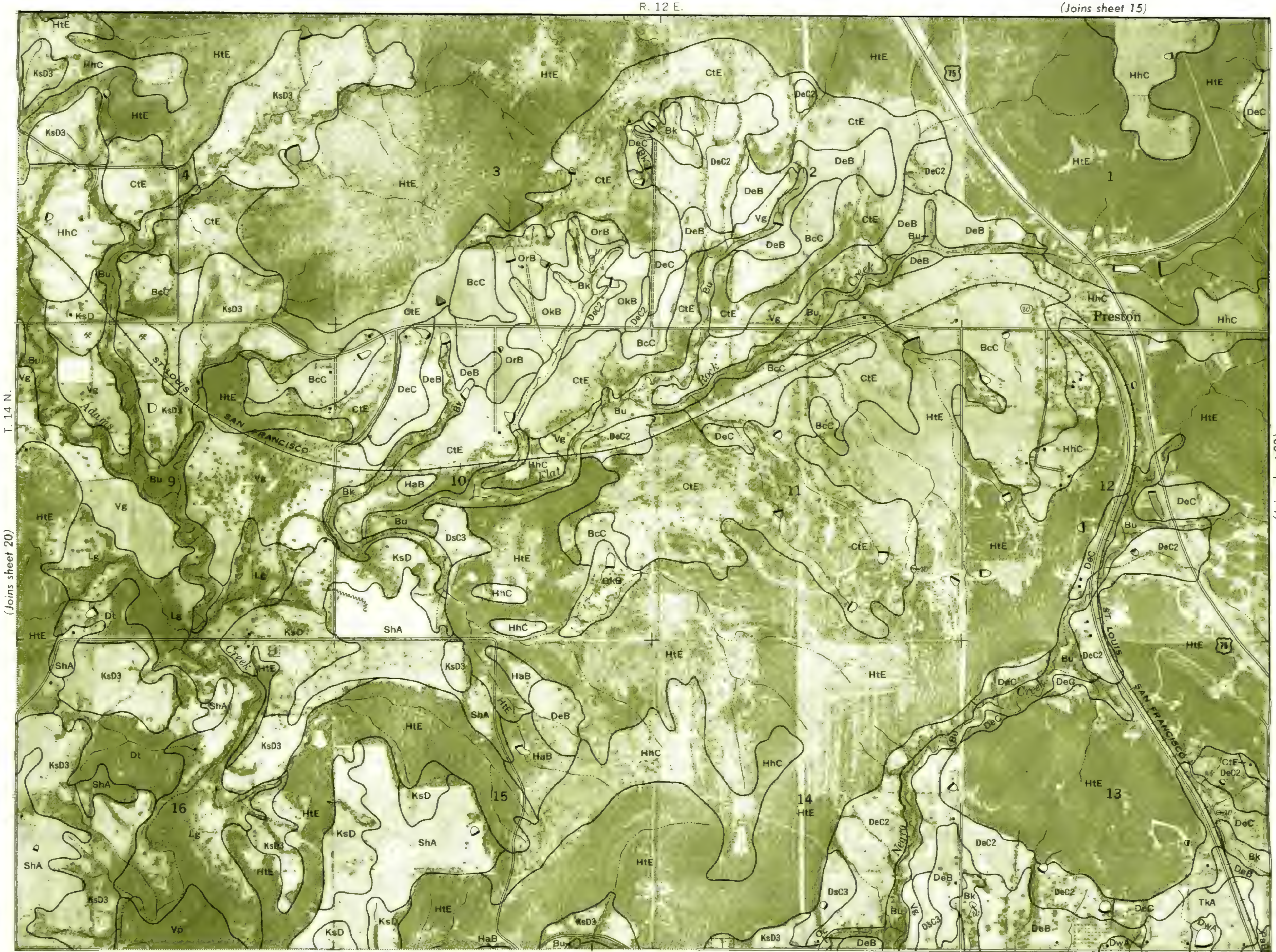
Range, township, and section corners shown on this map are indefinite

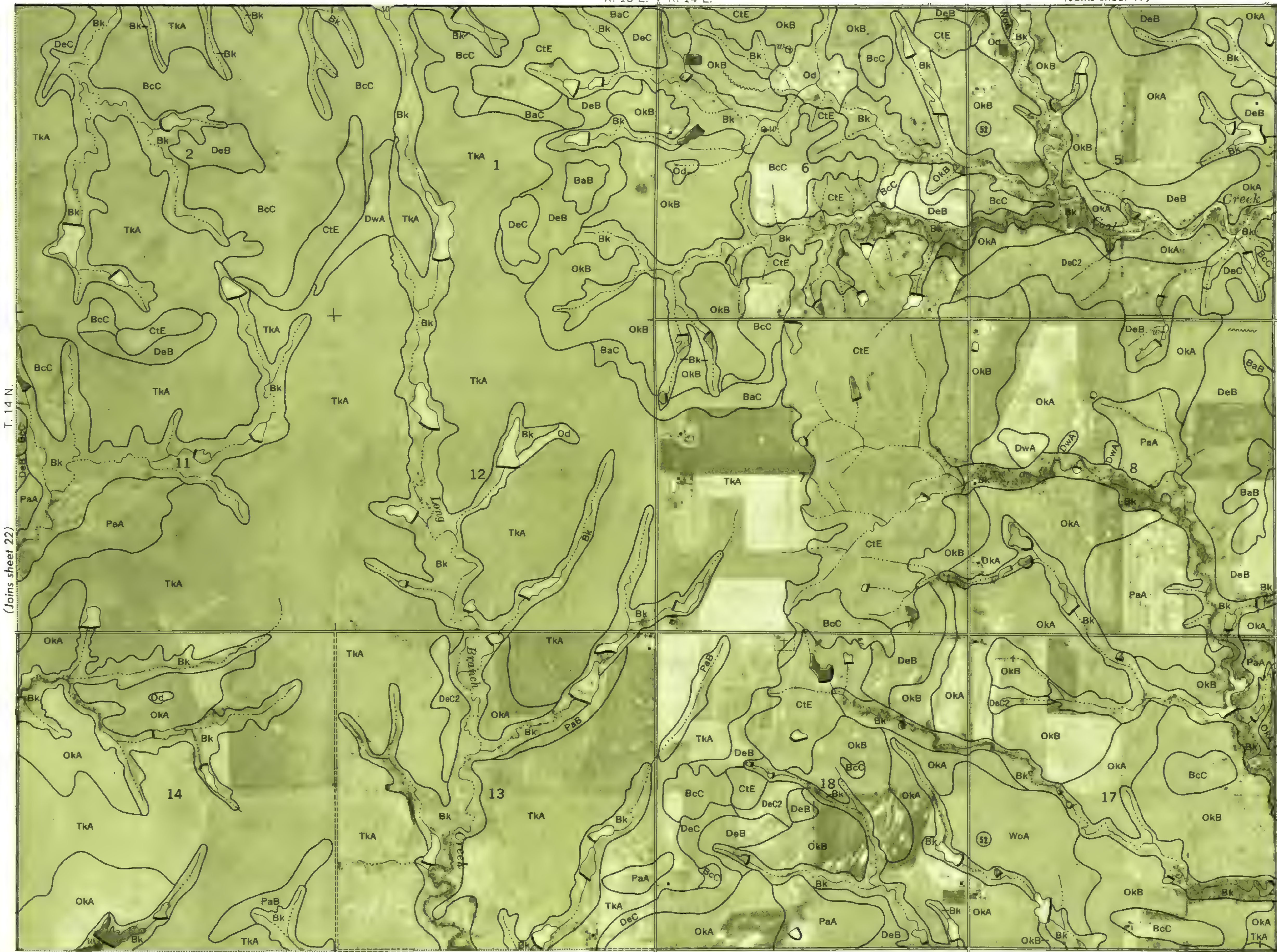
OKMULGEE COUNTY, OKLAHOMA NO. 21



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

22


(Joins sheet 16)
R. 13 E.
N
(Joins sheet 21)
T. 14 N.
(Joins sheet 23)
(Joins sheet 29)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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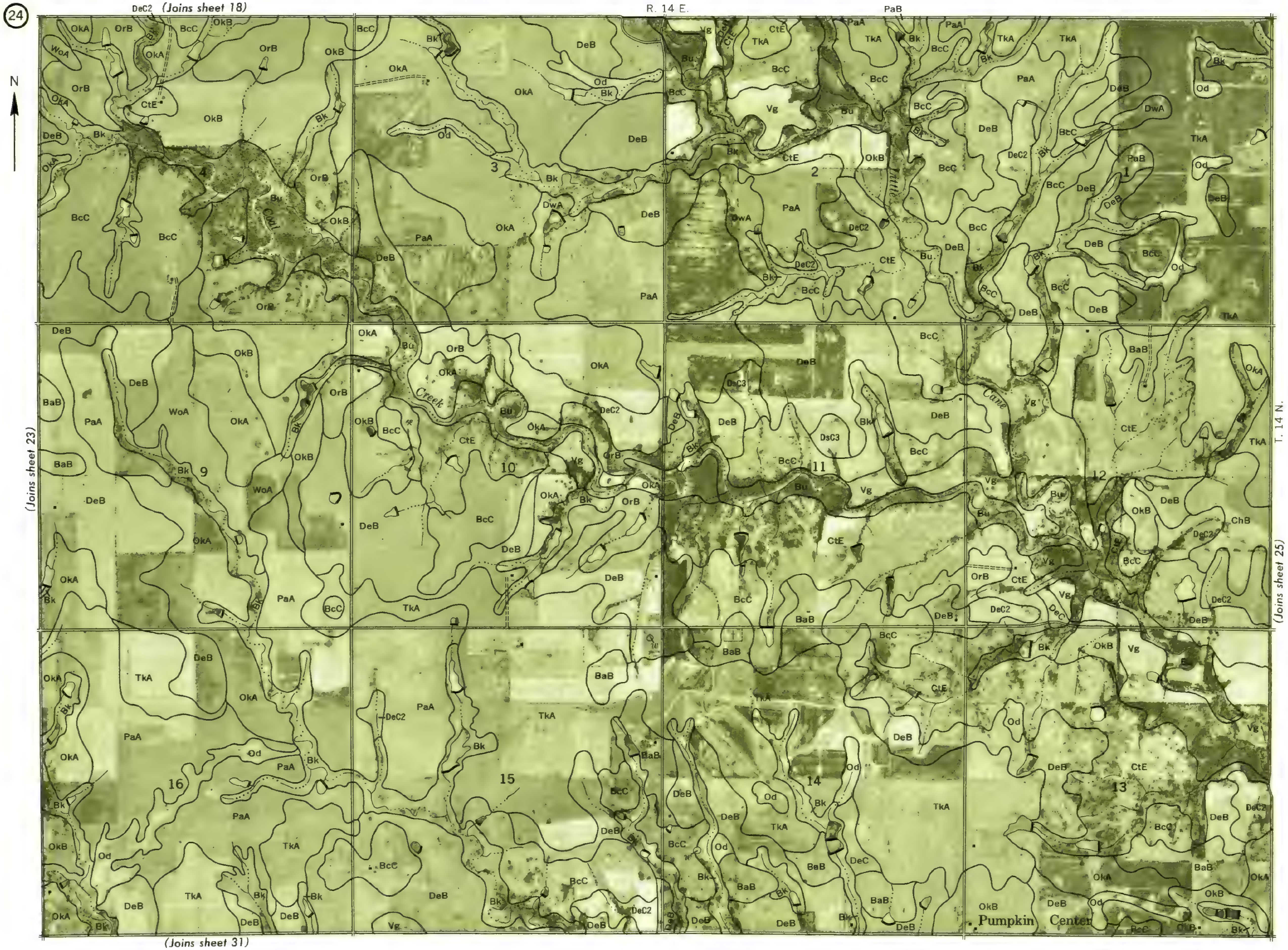
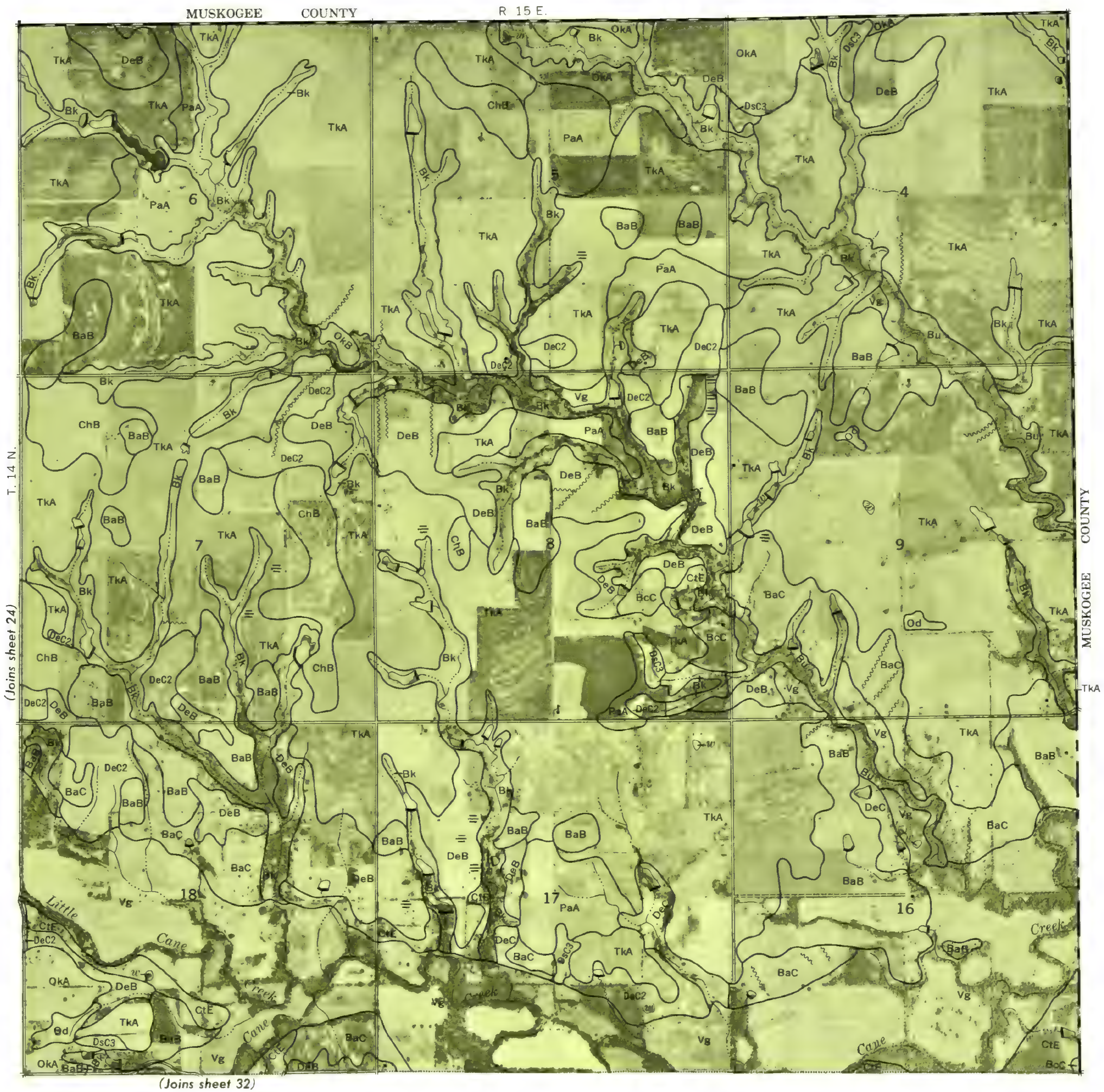
OKMULGEE COUNTY, OKLAHOMA NO. 23



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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OKMULGEE COUNTY, OKLAHOMA NO. 25

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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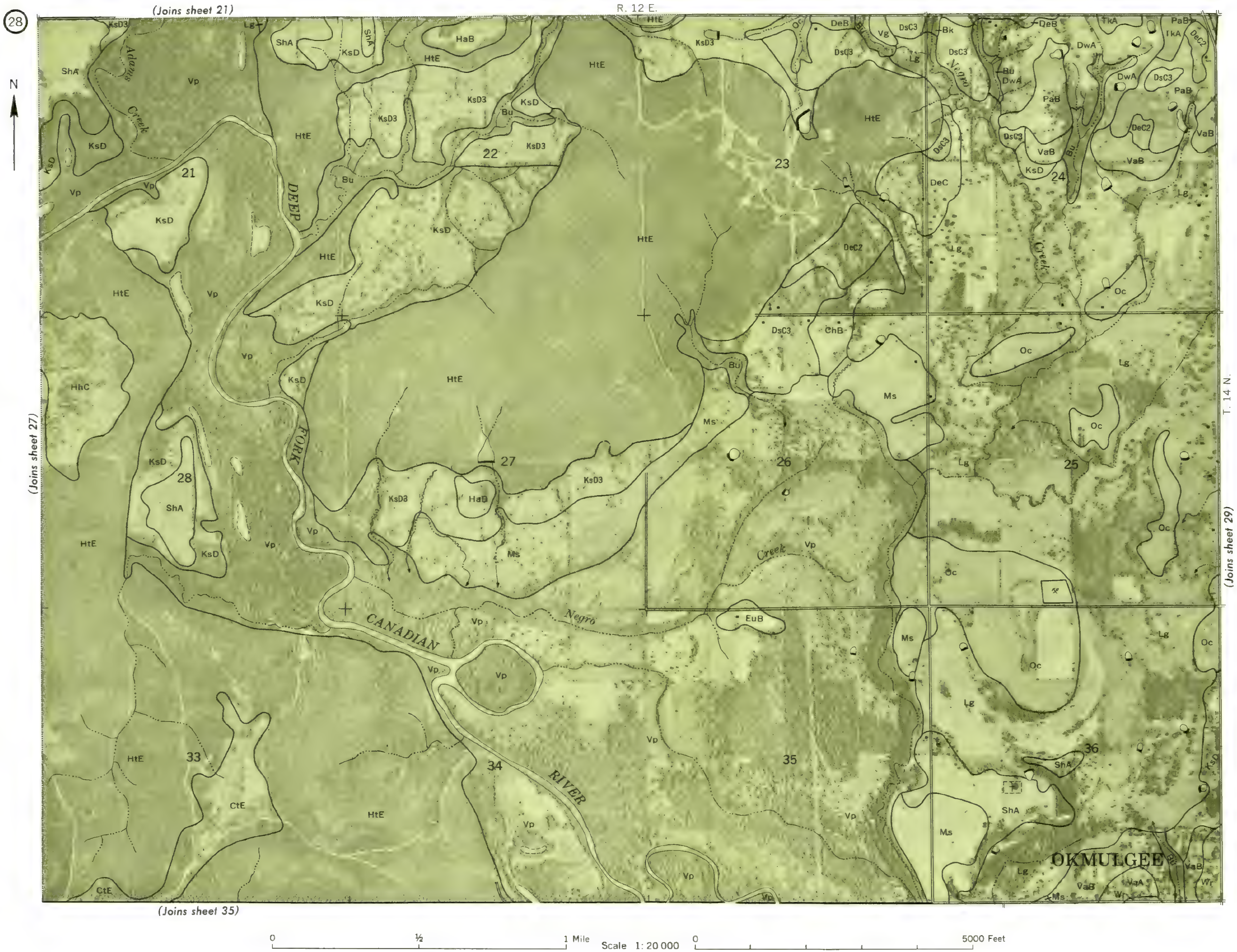
Range, township, and section corners shown on this map are indefinite.


28
(Joins sheet 21)
R. 12 E.
N
(Joins sheet 27)
(Joins sheet 29)
T. 14 N.
(Joins sheet 35)
21
22
23
24
25
26
27
28
33
34
35
36
Adams Creek
DEEP FORK
CANADIAN RIVER
Negro Creek
OKMULGEE
HtE
Vp
KsD
KsD3
ShA
HaB
Bu
HhC
CtE
Ms
Lg
Oc
DsC3
DeB
DeC
DeC2
ChB
EuB
DwA
PaB
VaB
Vg
IkA
Bk
Wr
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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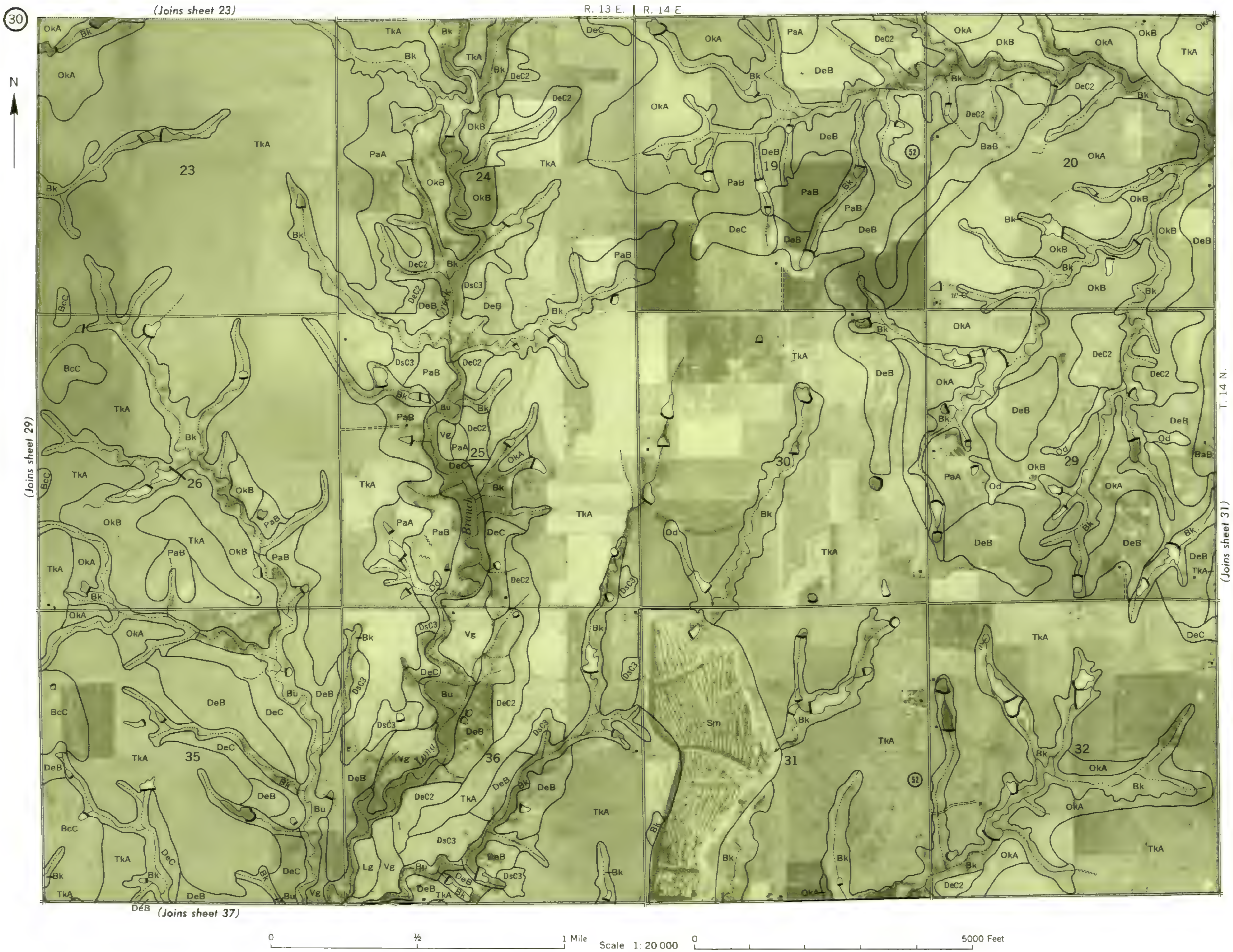
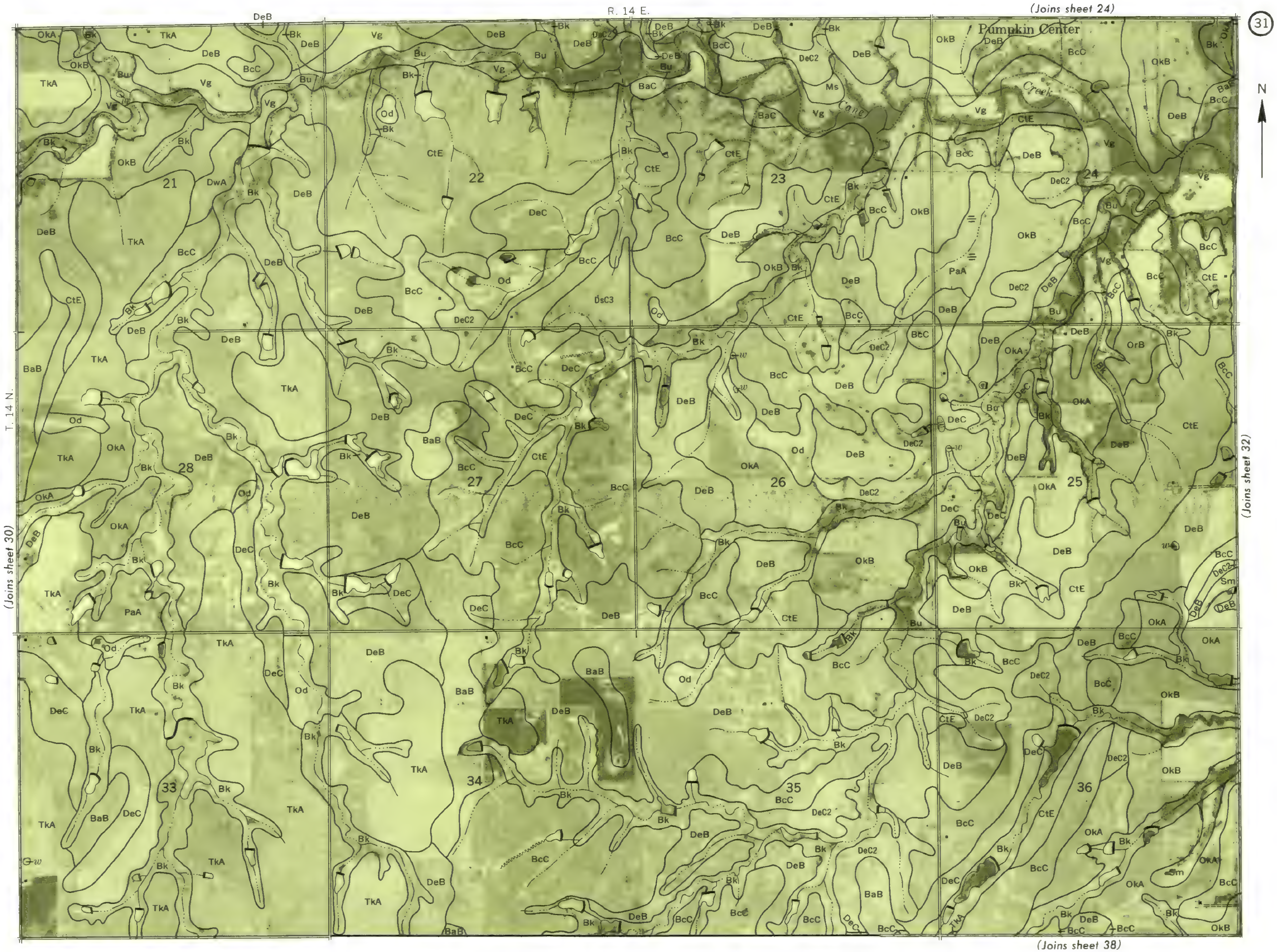
OKMULGEE COUNTY, OKLAHOMA NO. 29



OKMULGEE COUNTY, OKLAHOMA NO. 30



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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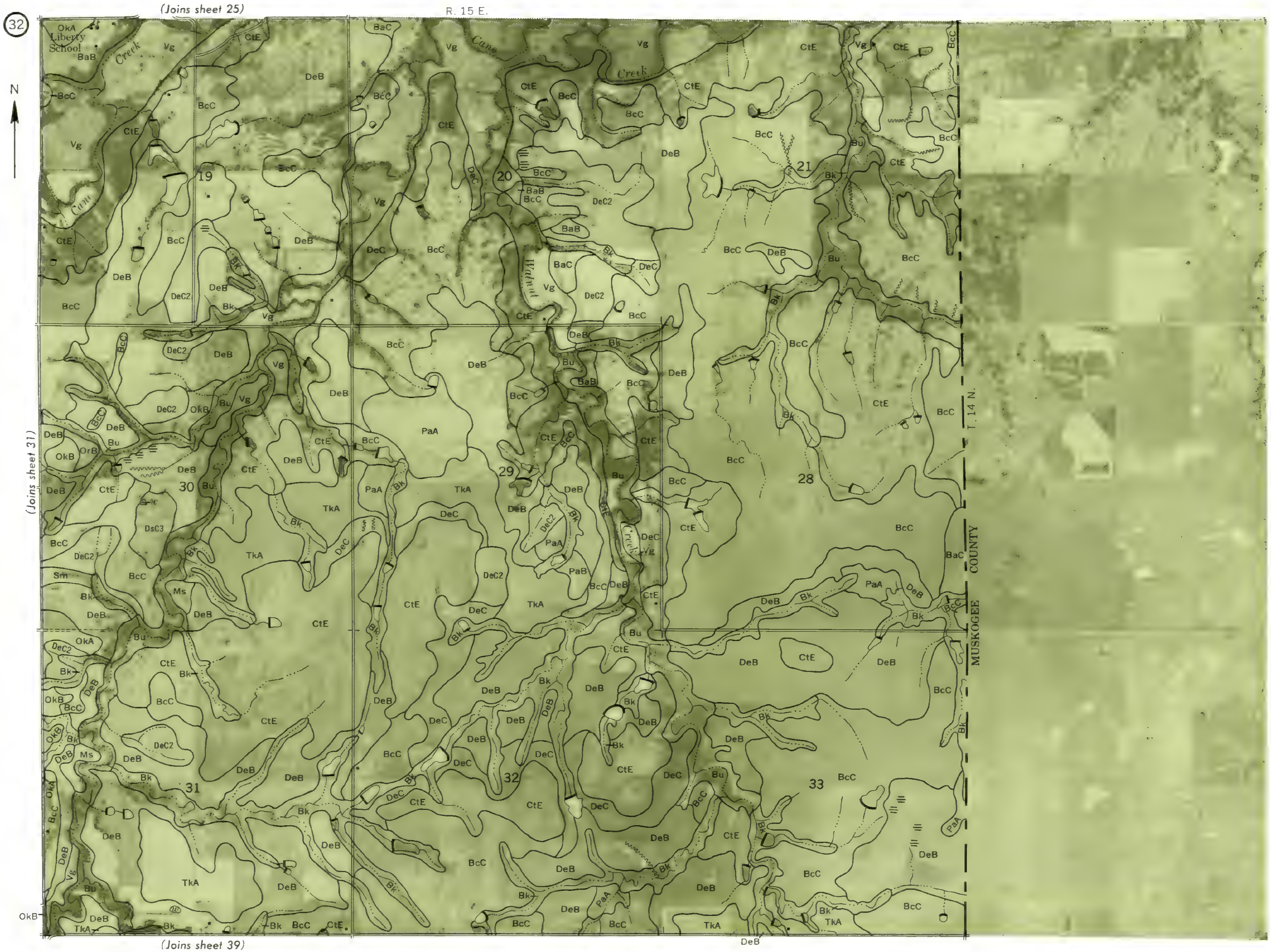
Range, township, and section corners shown on this map are indefinite.

OKMULGEE COUNTY, OKLAHOMA NO. 31

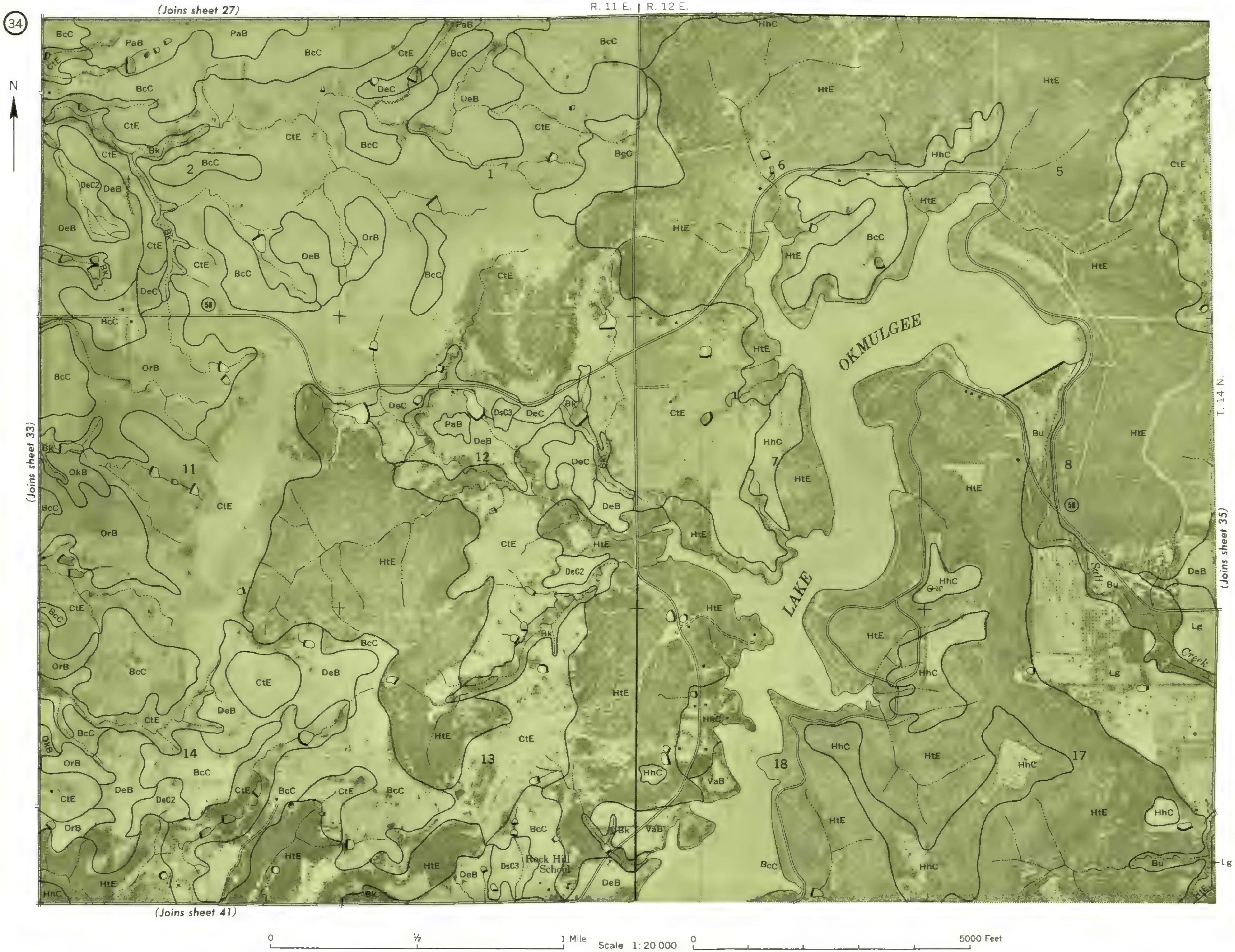


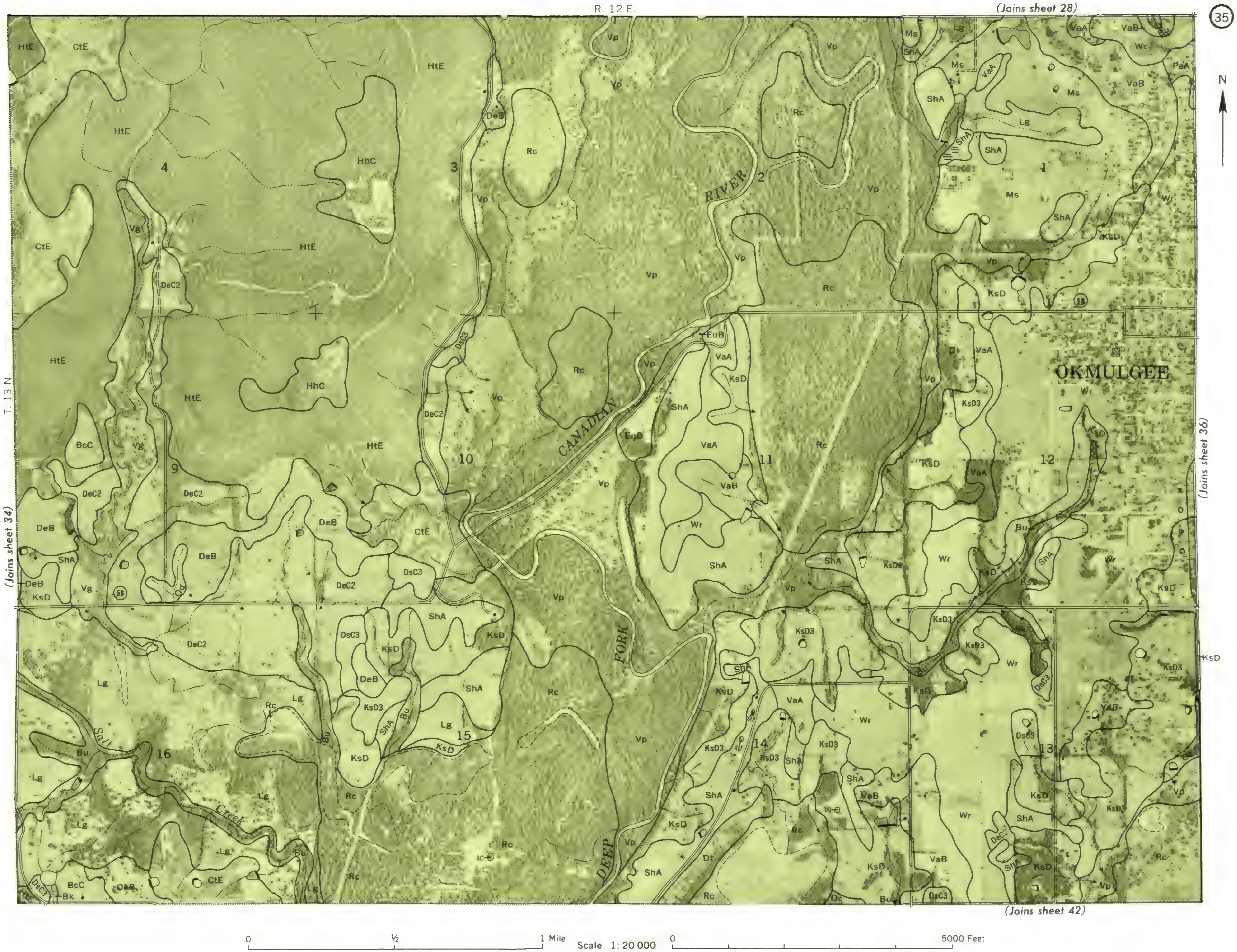
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

OKMULGEE COUNTY, OKLAHOMA NO. 32

OKMULGEE COUNTY, OKLAHOMA NO. 33

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.
Range, township, and section corners shown on this map are indefinite.


34
(Joins sheet 27)
R. 11 E. | R. 12 E.
N
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
T. 14 N.
LAKE OKMULGEE
Salt Creek
Rock Hill School
BcC
PaB
CtE
DeC
DeB
OrB
DeC2
DsC3
OkB
HtE
HhC
VaB
Bu
Lg
Bk
1
2
5
6
7
8
11
12
13
14
17
18
56
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet



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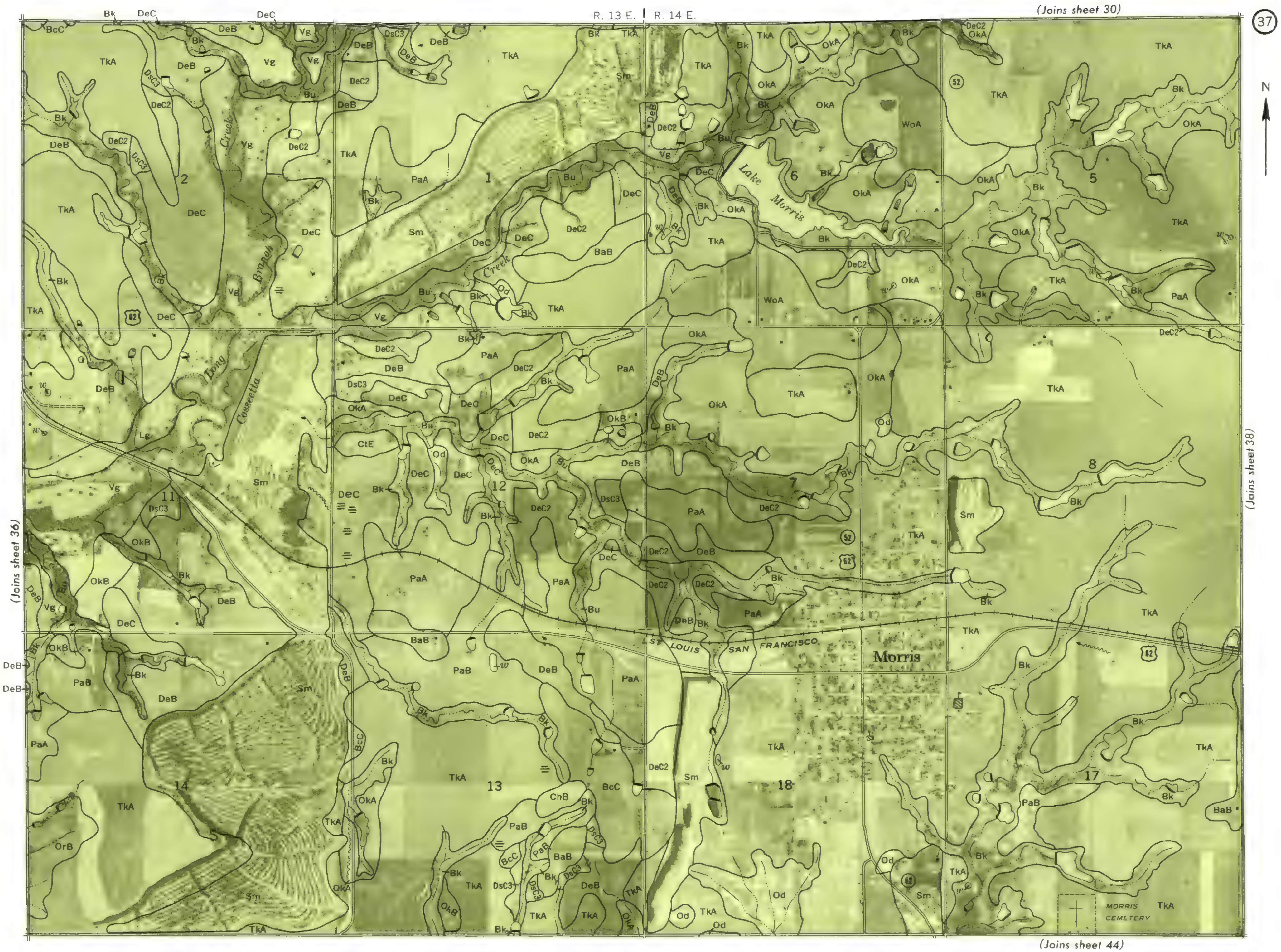
Range, township, and section corners shown on this map are indefinite.

OKMULGEE COUNTY, OKLAHOMA NO. 35

OKMULGEE COUNTY, OKLAHOMA NO. 36



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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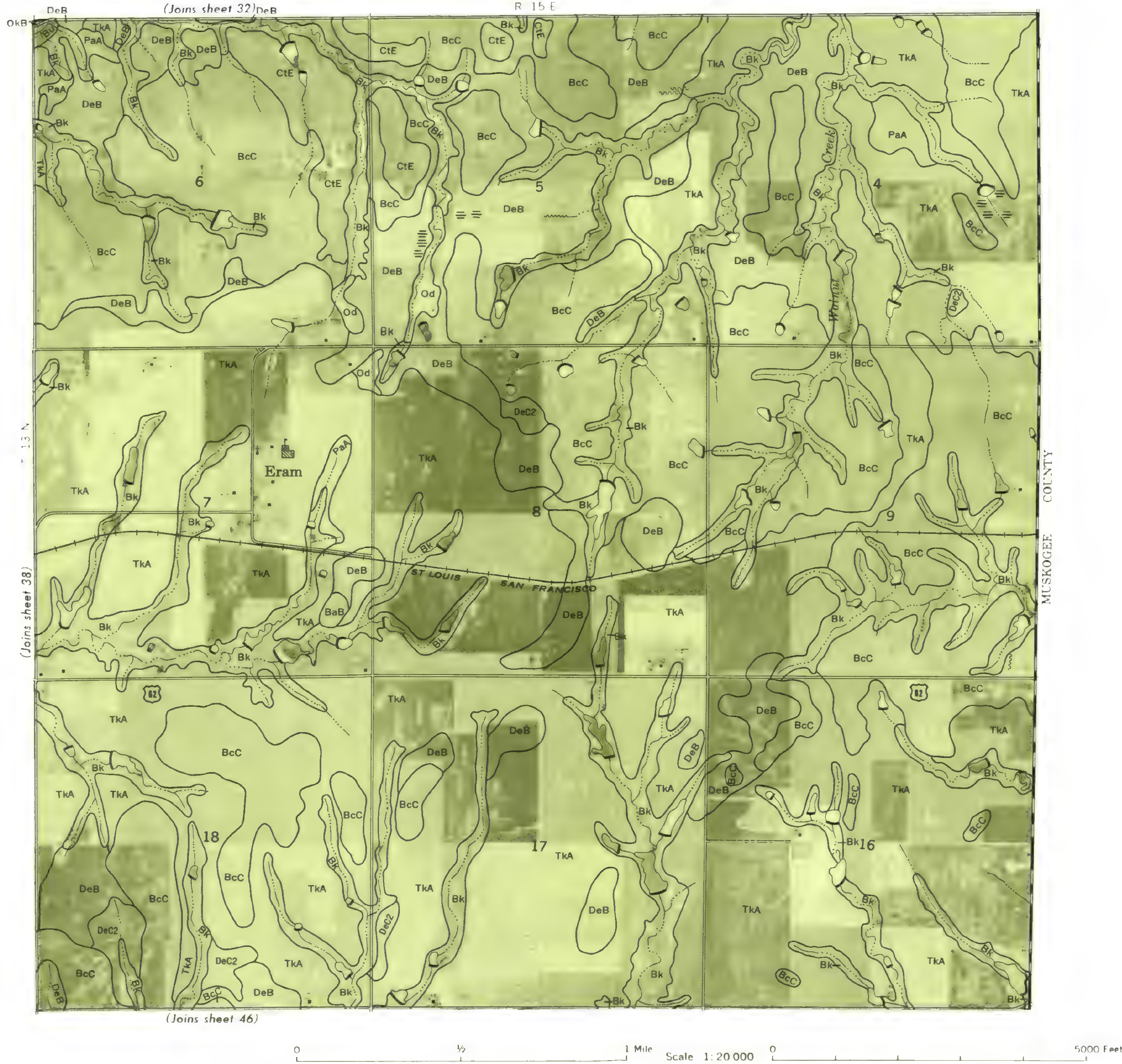
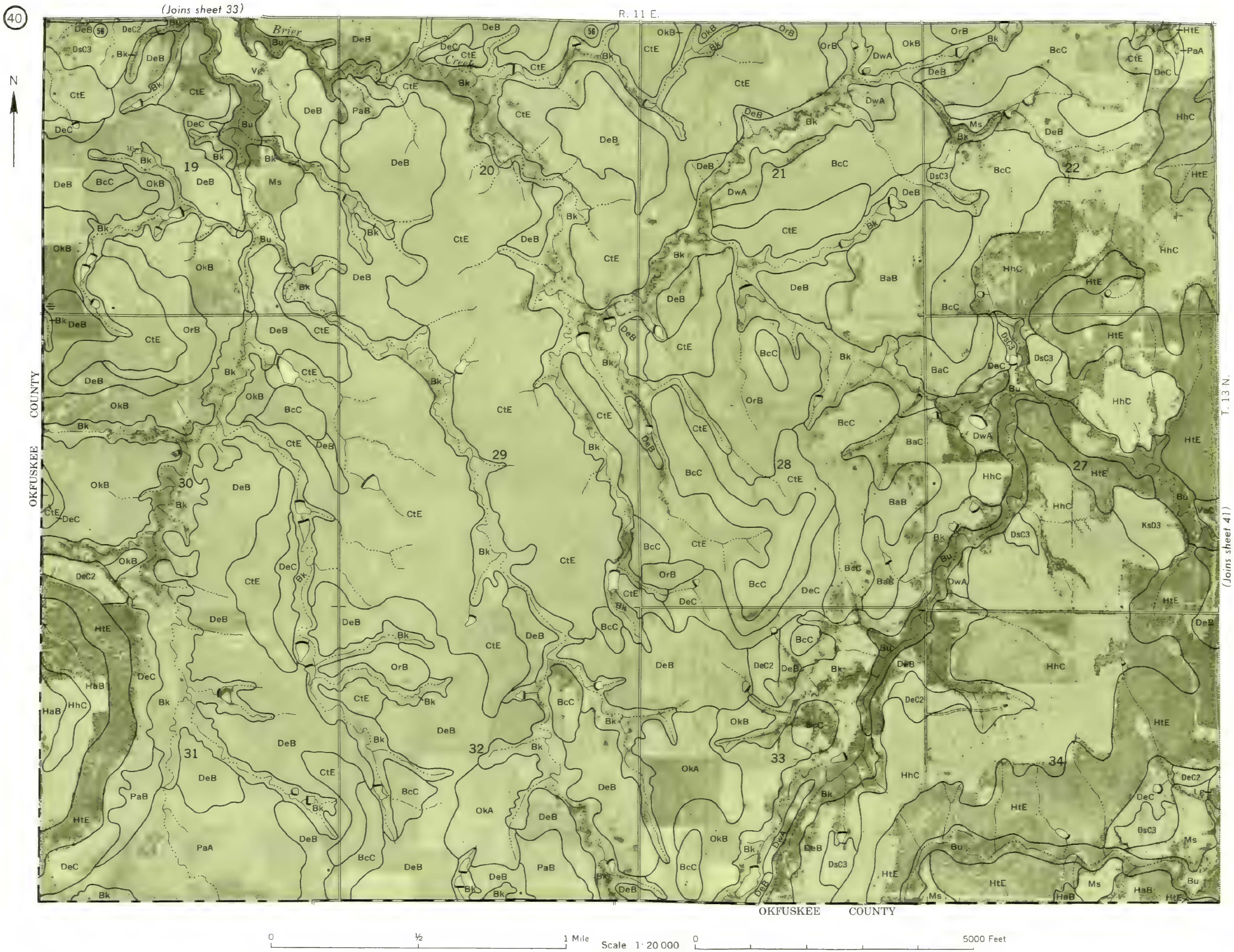
Range, township, and section corners shown on this map are indefinite.


38
(Joins sheet 31)
R. 14 E.
N
(Joins sheet 37)
(Joins sheet 39)
T. 13 N.
(Joins sheet 45)
ST LOUIS SAN FRANCISCO
62
0
½
1 Mile
Scale 1:20 000
0
5000 Feet



N

OKMULGEE COUNTY, OKLAHOMA NO. 39



OKMULGEE COUNTY, OKLAHOMA NO 40

OKMULGEE COUNTY, OKLAHOMA NO. 41

BcC R. 11 E. | R. 12 E. (Joins sheet 34)

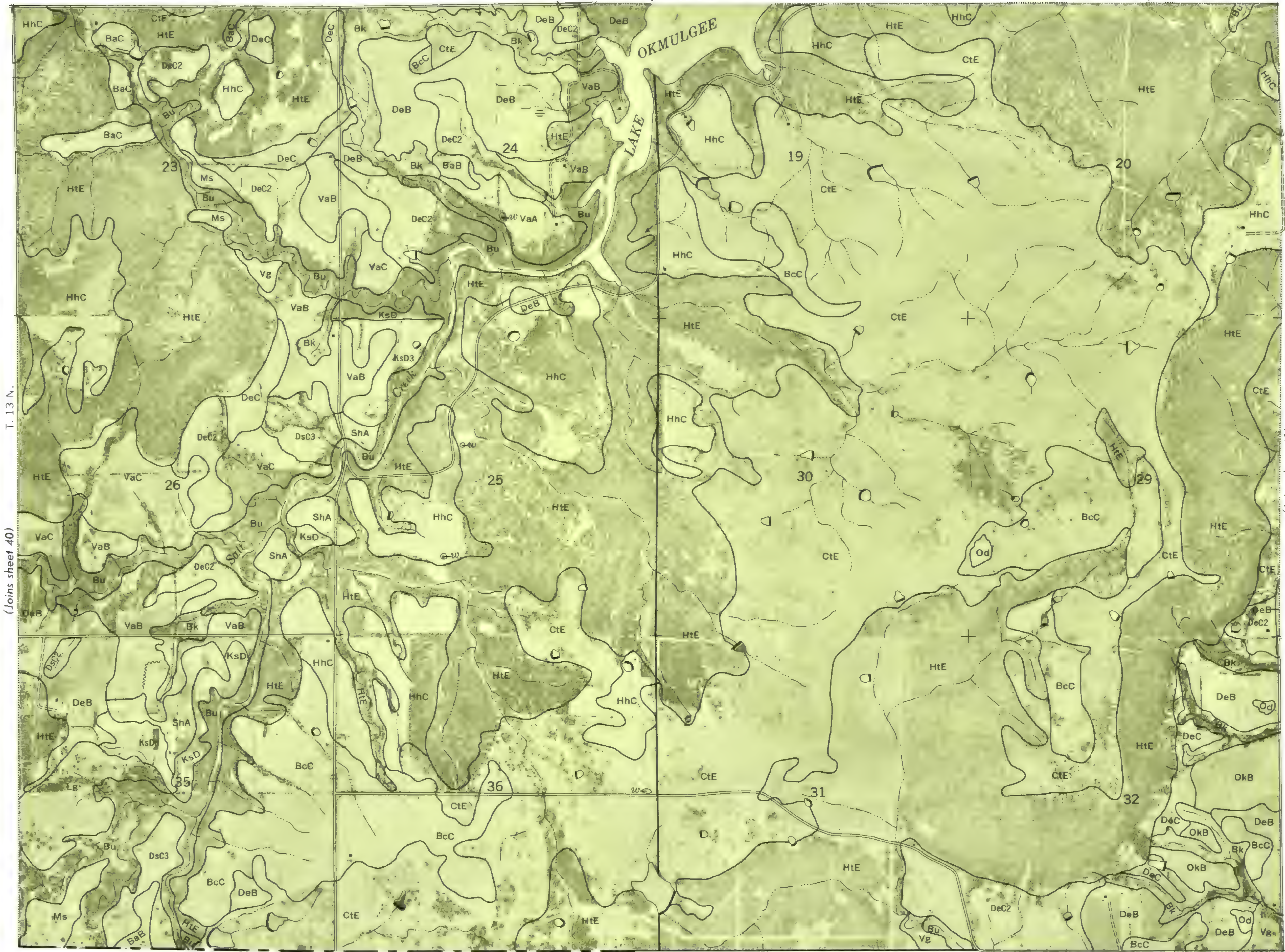
41

N

T. 13 N.

(Joins sheet 40)

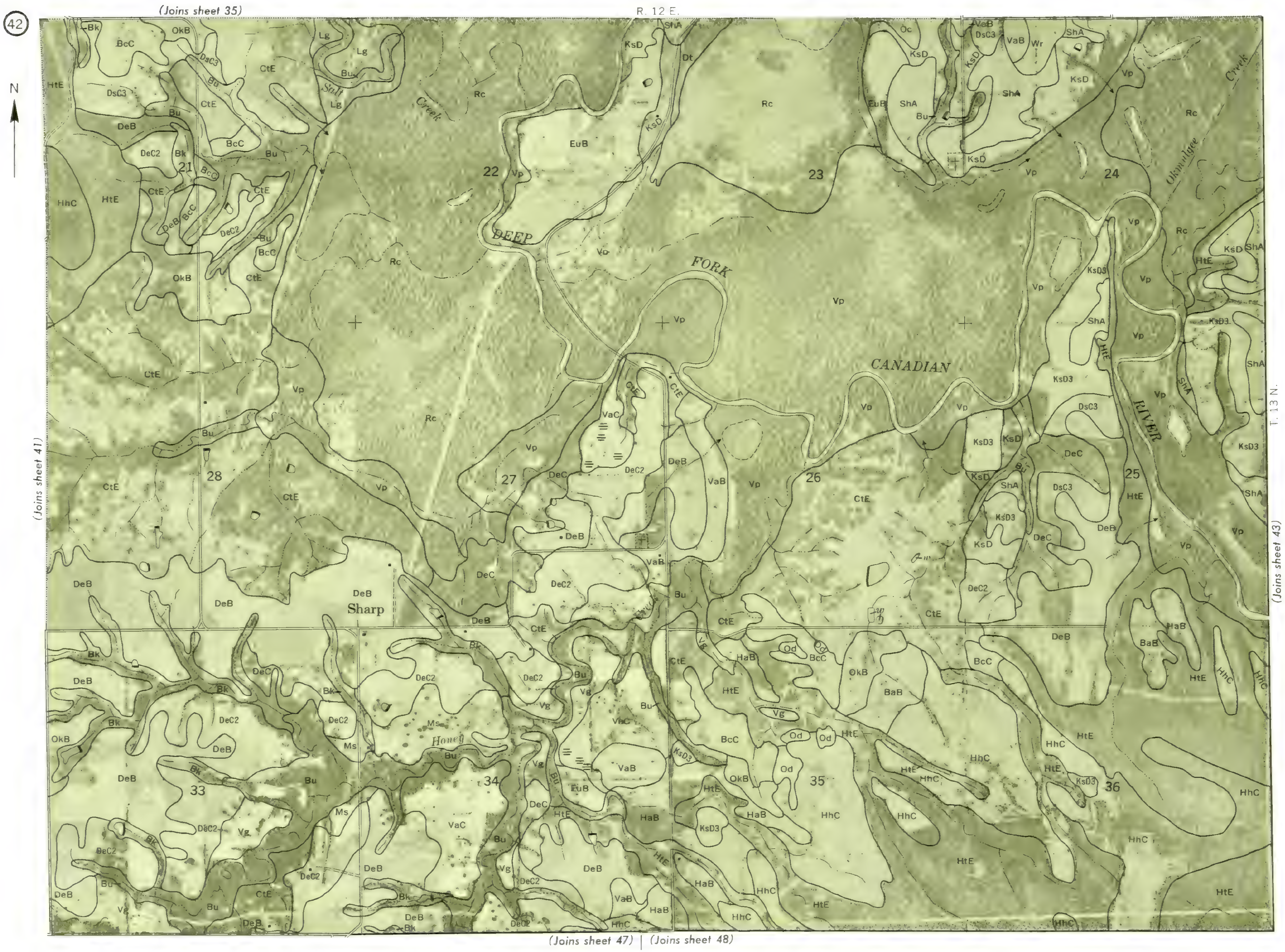
(Joins sheet 42)



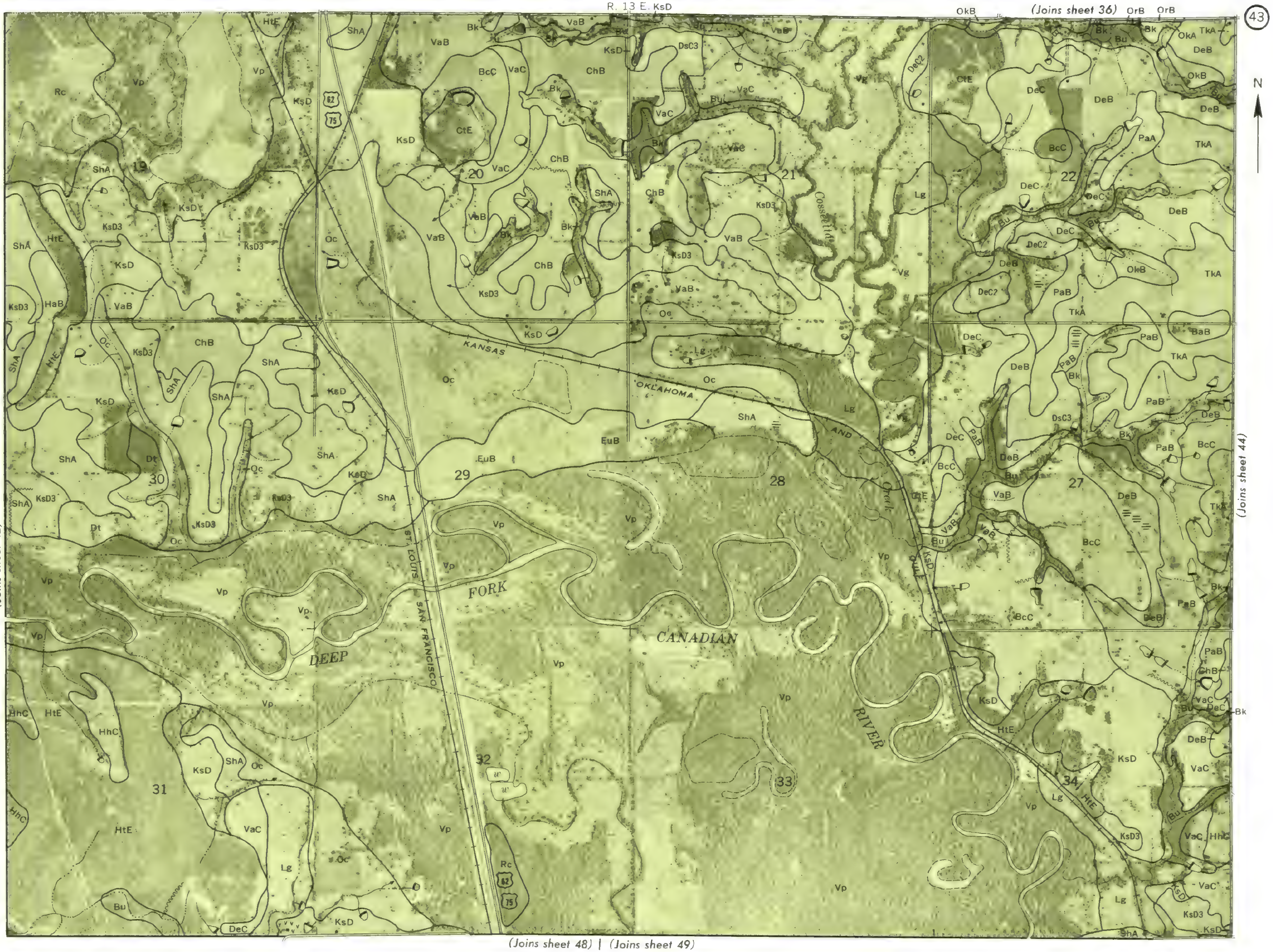
OKFUSKEE COUNTY

(Joins sheet 47)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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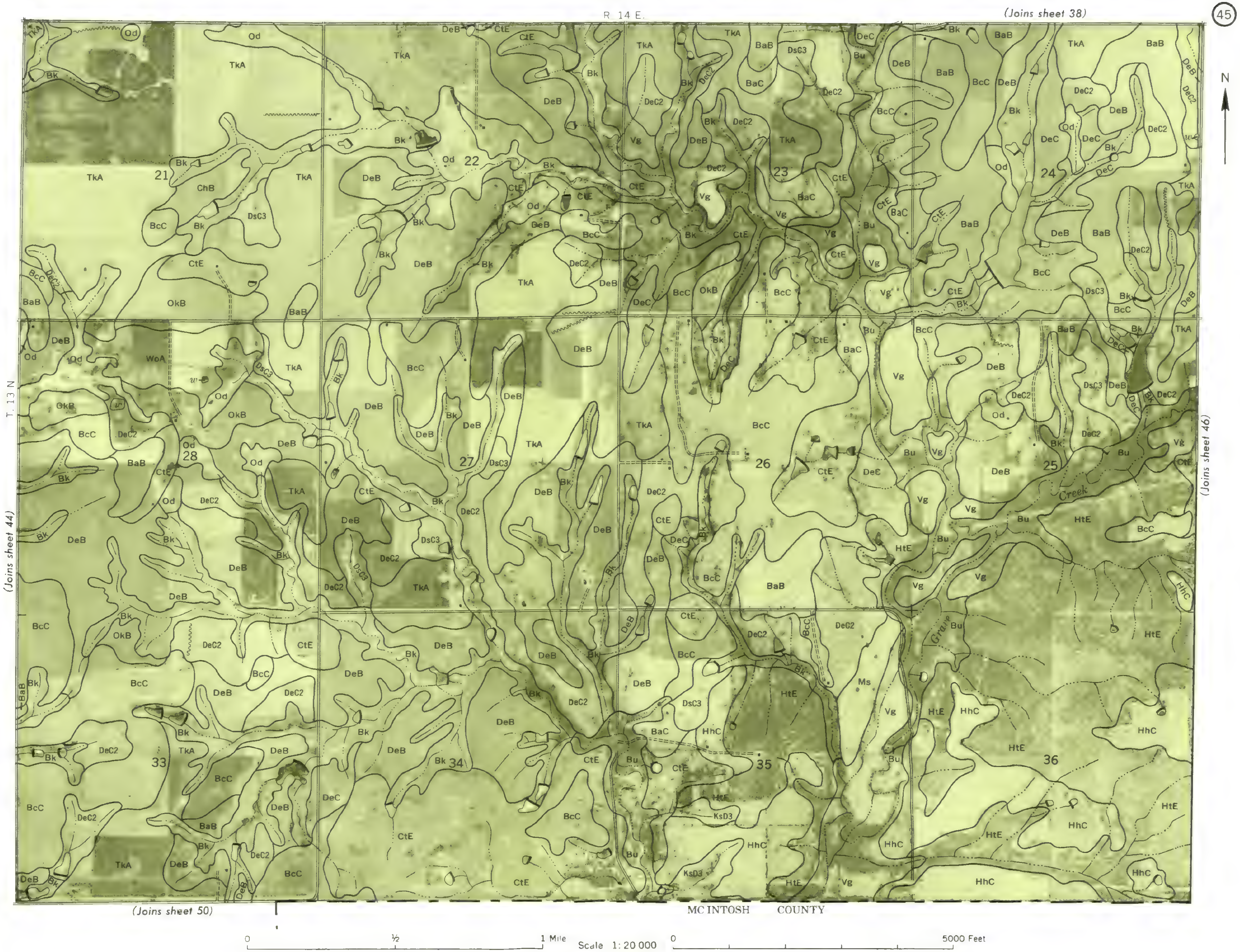
Range, township, and section corners shown on this map are indefinite.

OKMULGEE COUNTY, OKLAHOMA NO. 43

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

OKMULGEE COUNTY, OKLAHOMA NO. 44



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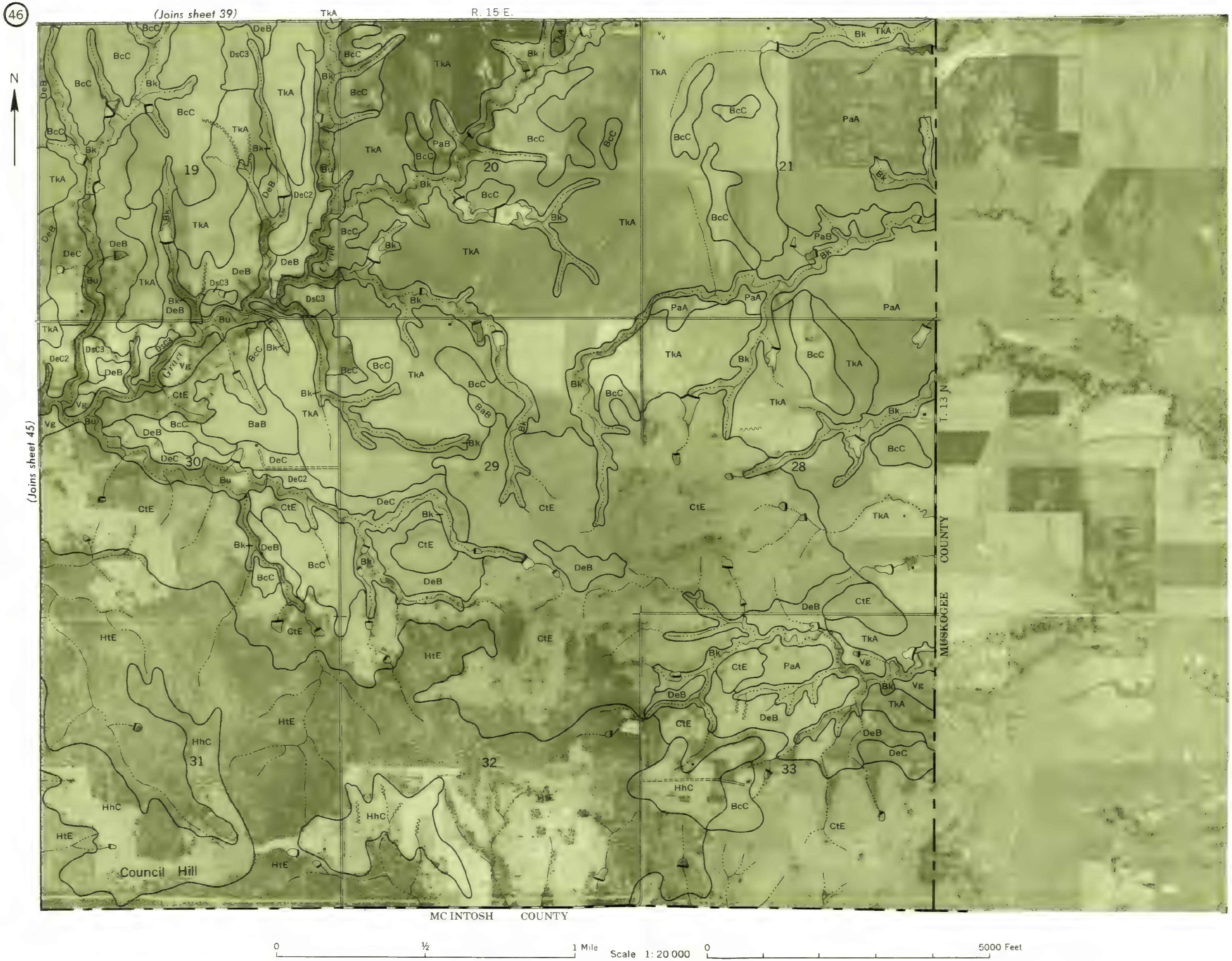
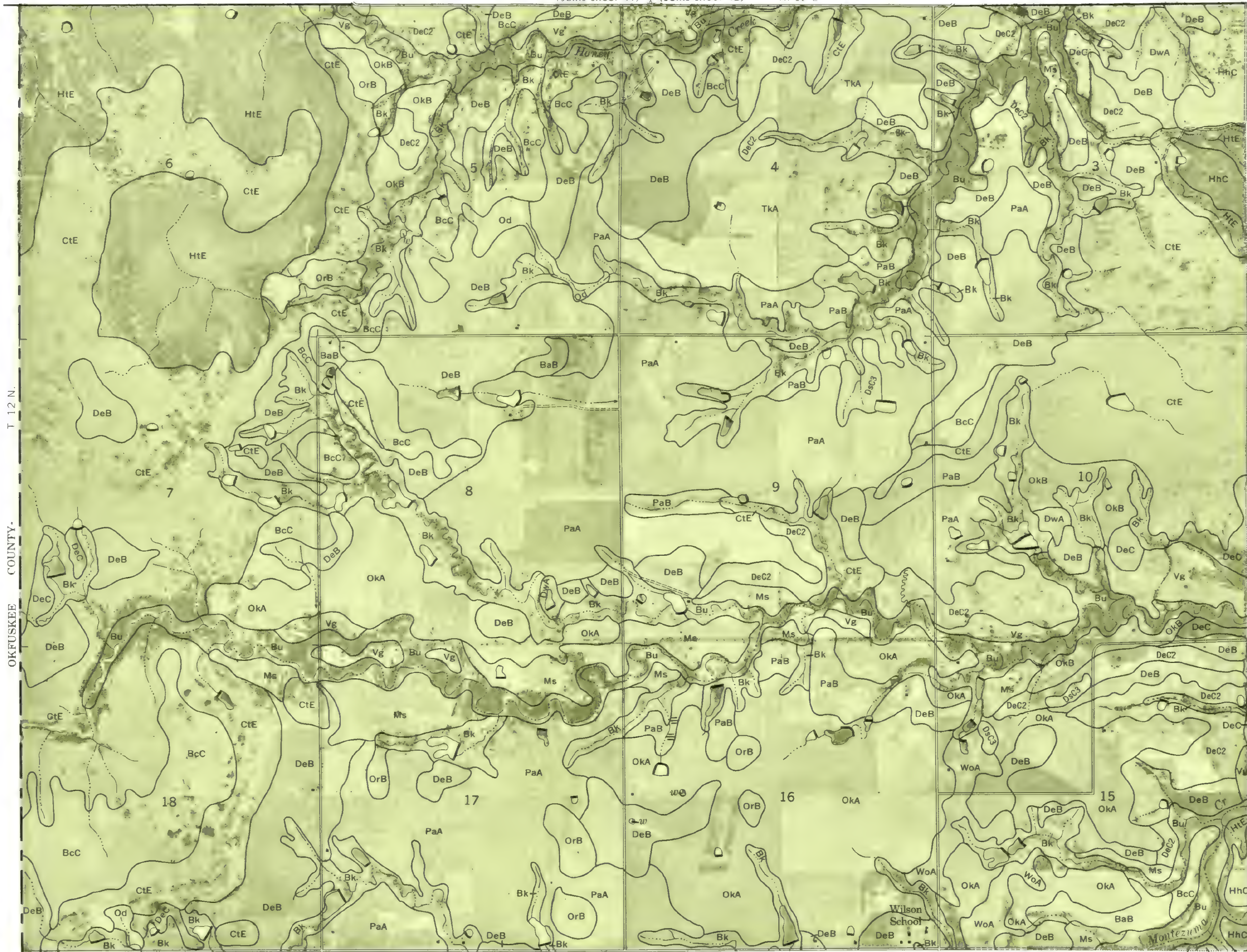
OKMULGEE COUNTY, OKLAHOMA NO. 45


46
(Joins sheet 39)
R. 15 E.
N
(Joins sheet 45)
T. 13 N.
MUSKOGEE COUNTY
MC INTOSH COUNTY
19
20
21
28
29
30
31
32
33
Council Hill
Gran Creek
TkA
BcC
Bk
DeB
DsC3
DeC2
DeC
Bu
PaB
PaA
BaB
Vg
CtE
HtE
HhC
0
½
1 Mile
Scale 1:20 000
0
5000 Feet

(Joins sheet 41) | (Joins sheet 42) R. 12 E.



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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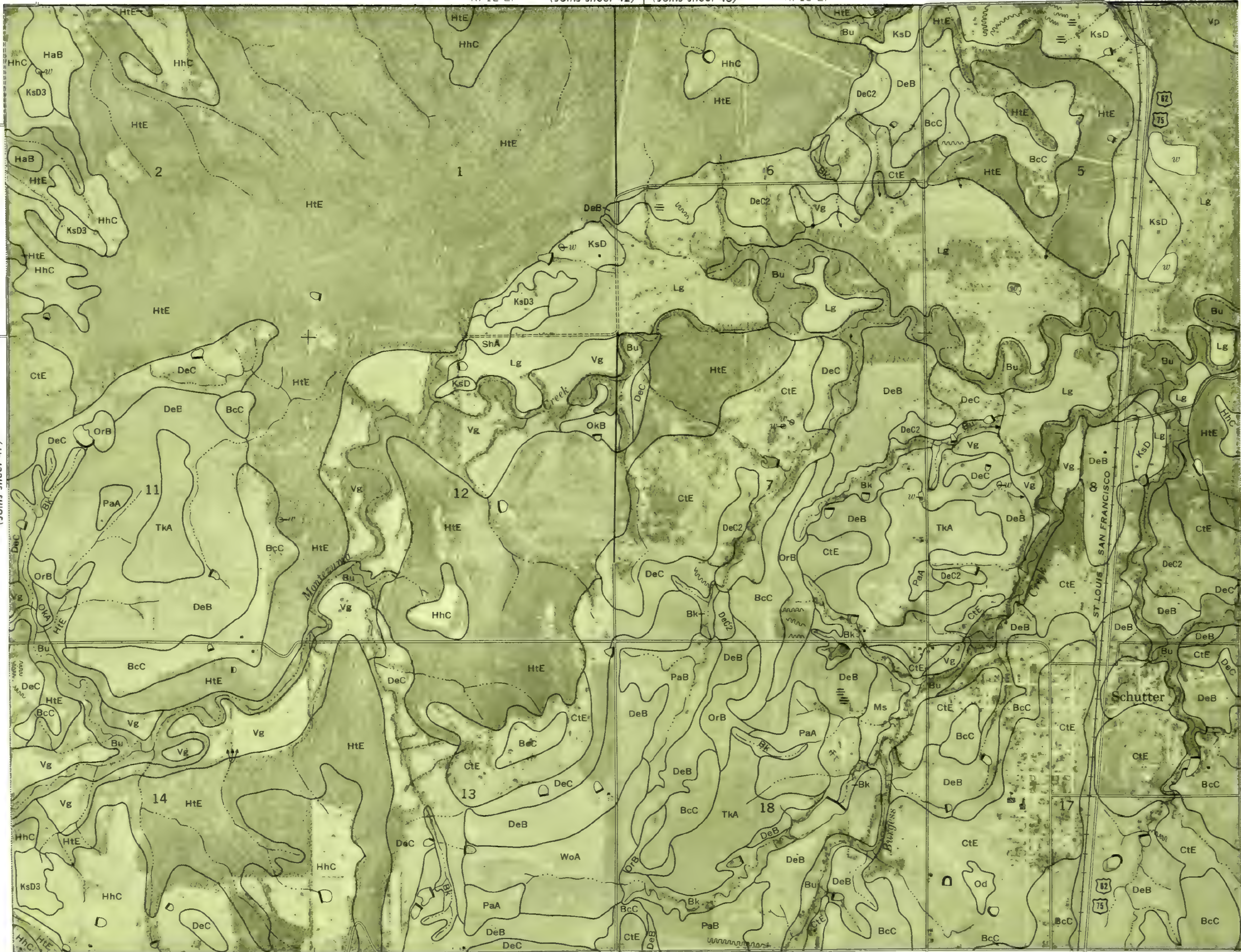
OKMULGEE COUNTY, OKLAHOMA NO. 47

48

R. 12 E. (Joins sheet 42) | (Joins sheet 43) R. 13 E.

N

(Joins sheet 47)

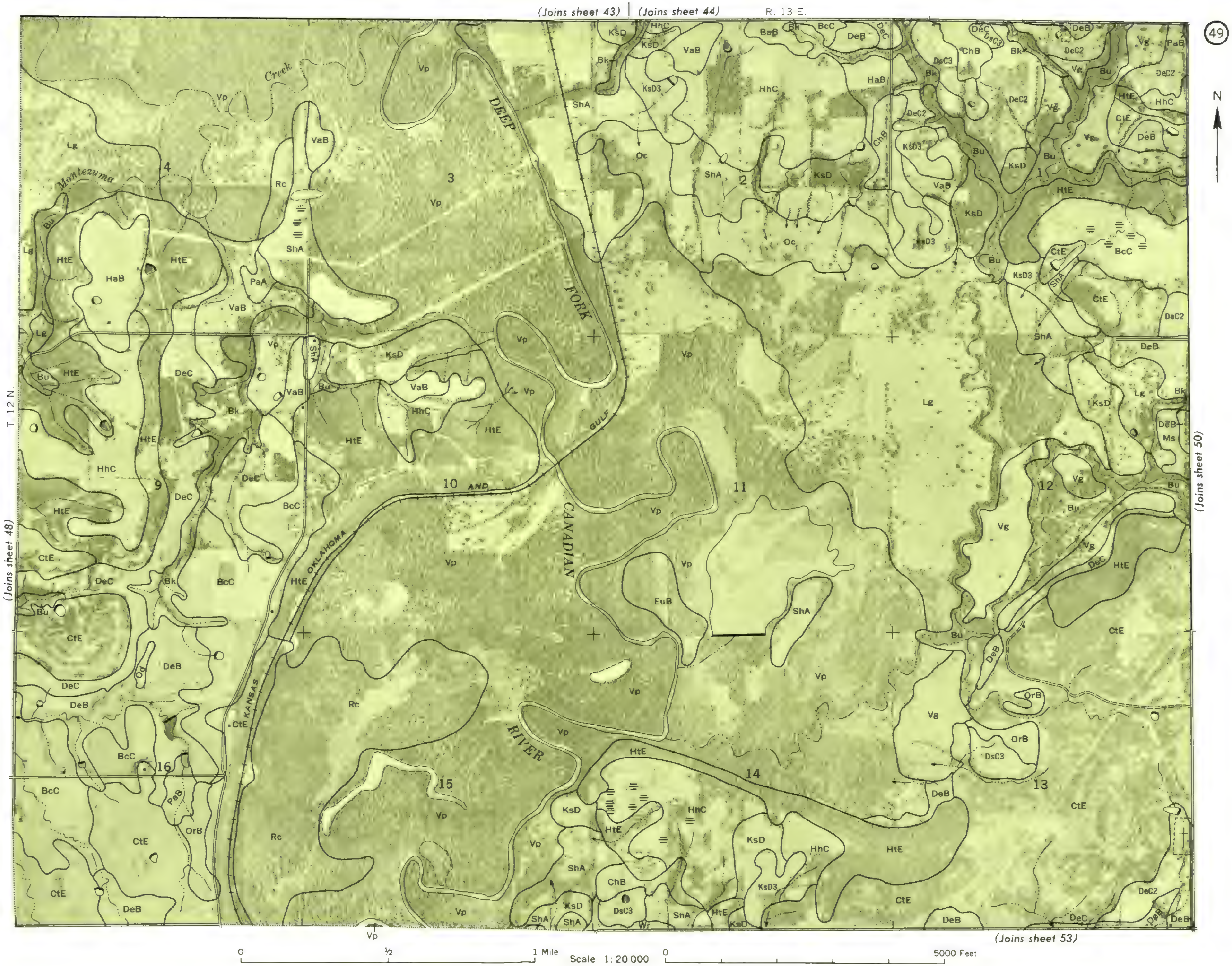


T. 12 N.

(Joins sheet 49)

(Joins sheet 52)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



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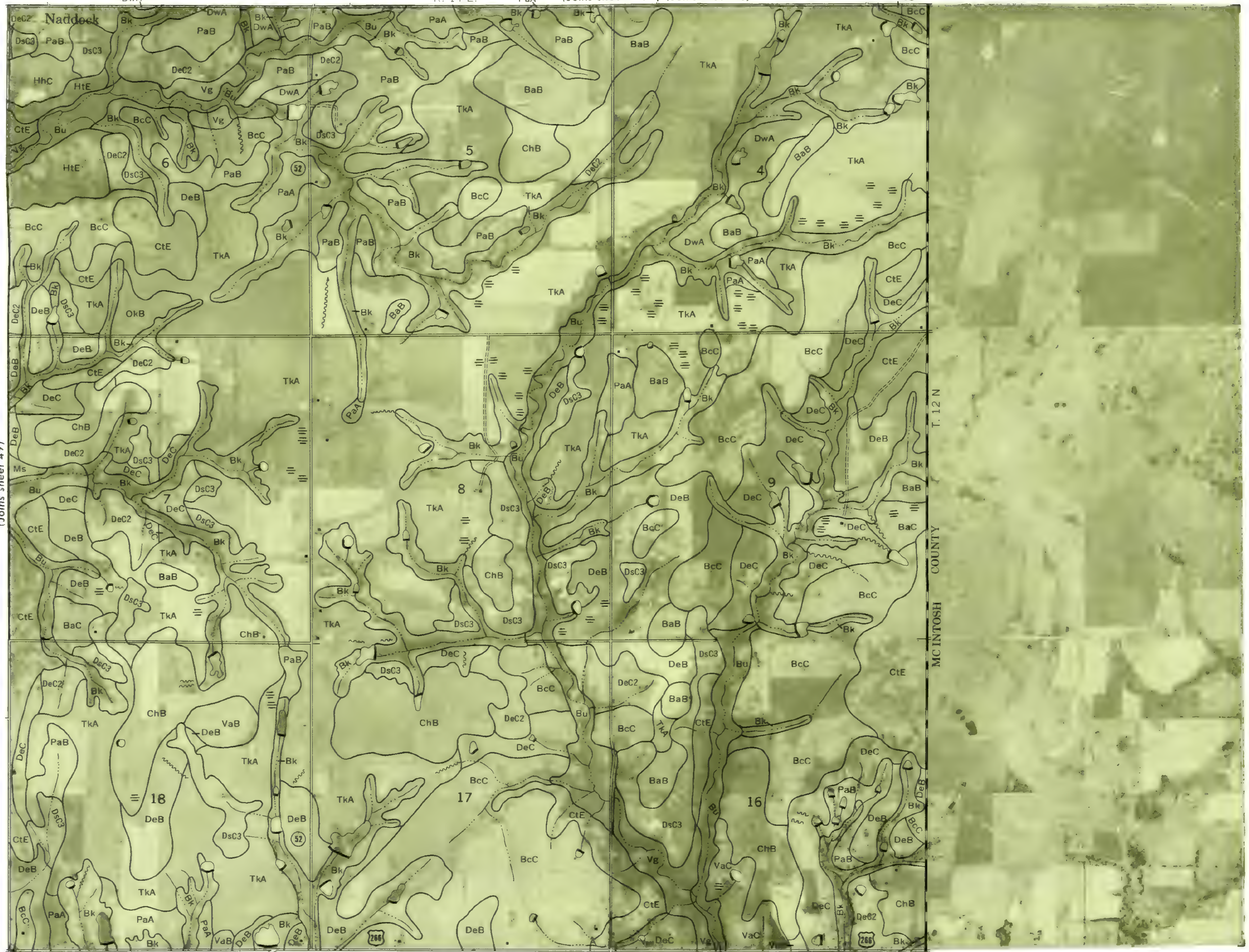
Range, township, and section corners shown on this map are indefinite.

OKMULGEE COUNTY, OKLAHOMA NO. 49

(50)

R. 14 E. (Joins sheet 44) | (Joins sheet 45)



(Joins sheet 49)

(Joins sheet 54)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

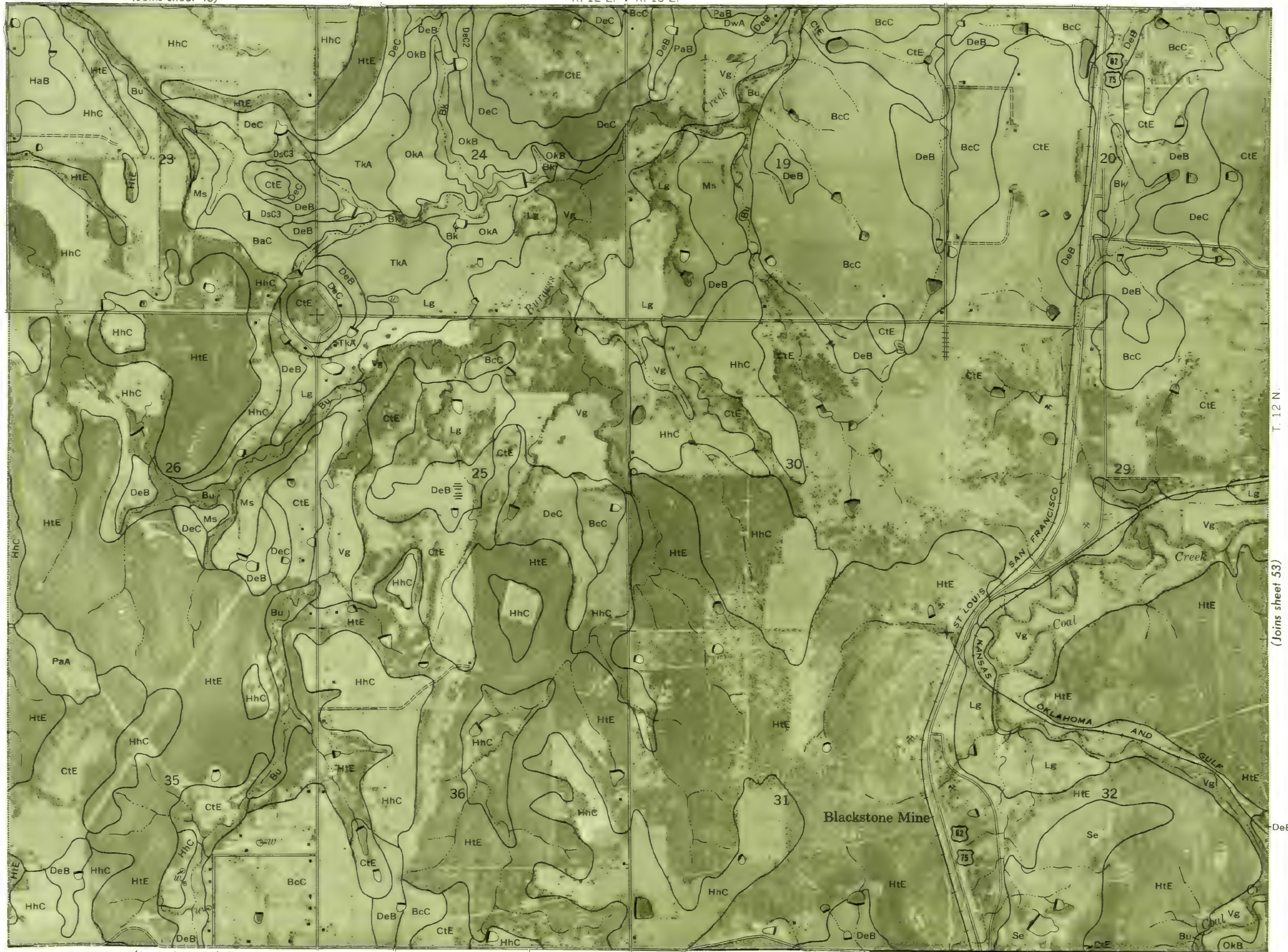
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.
Range, township, and section corners shown on this map are indefinite.

52

(Joins sheet 48)

R. 12 E. | R. 13 E.



(Joins sheet 56)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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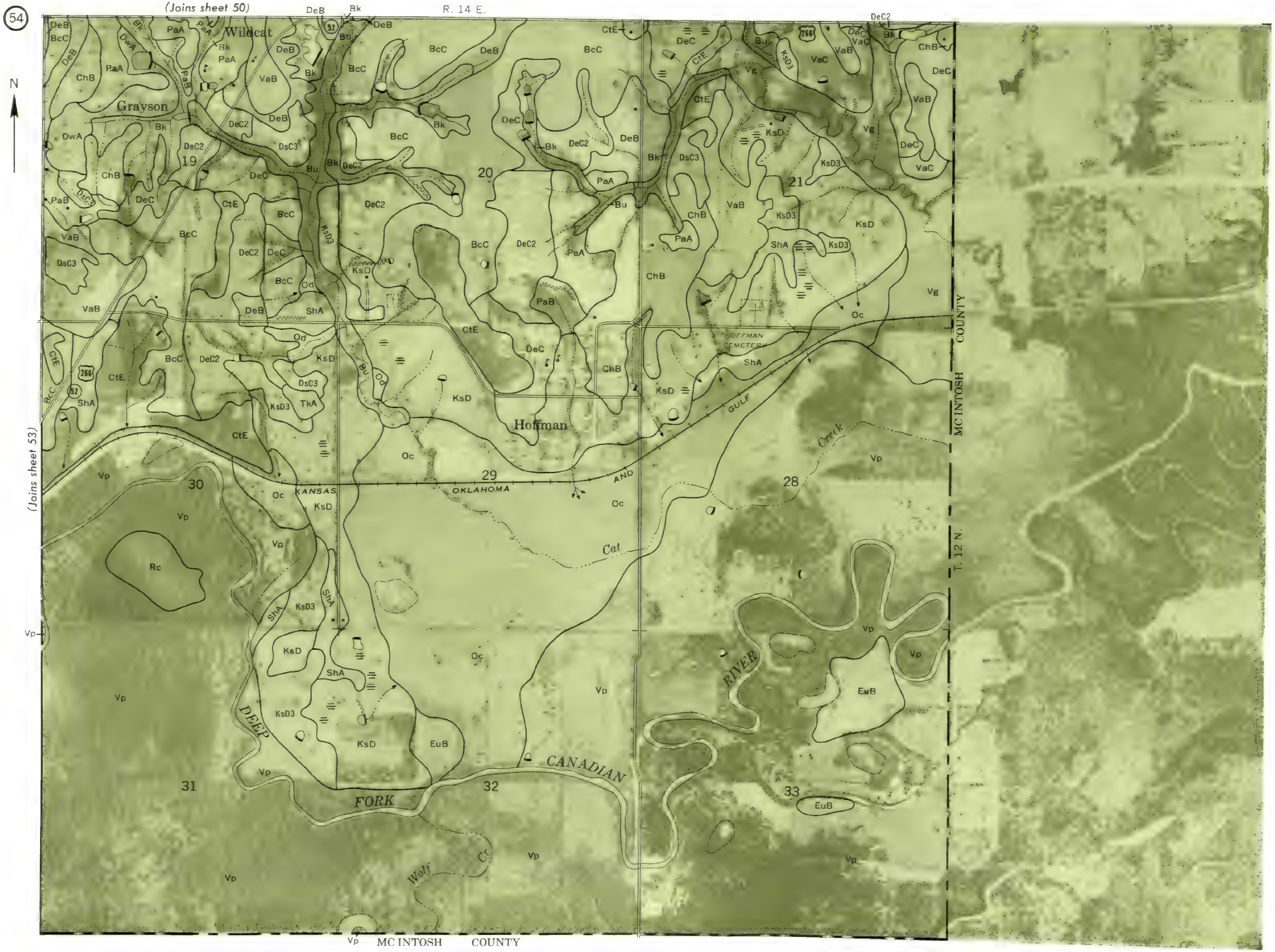
Range, township, and section corners shown on this map are indefinite

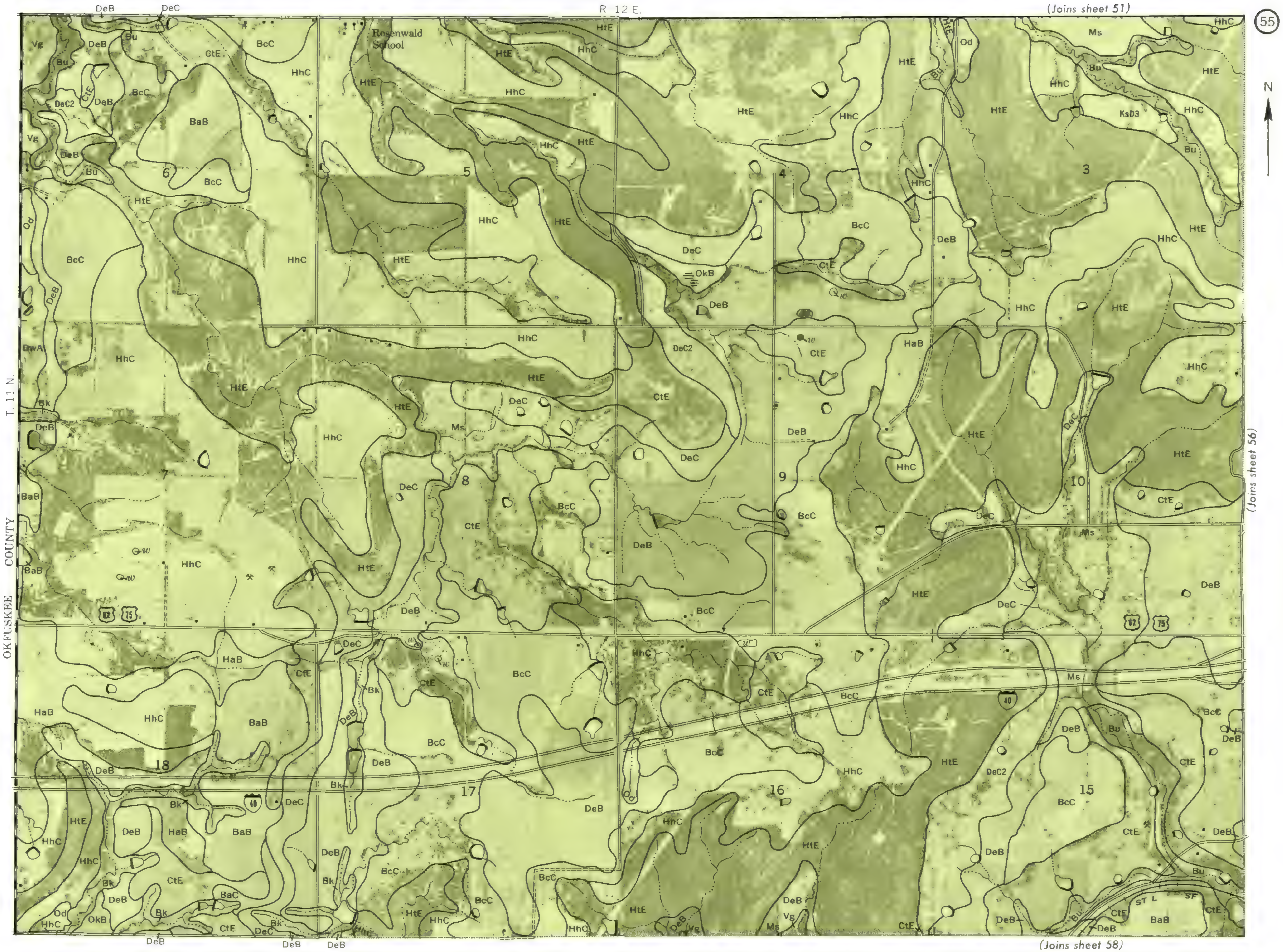
OKMULGEE COUNTY, OKLAHOMA NO. 53

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



Scale 1:20 000 — 0 — ½ — 1 Mile — 0 — 5000 Feet

OKMULGEE COUNTY OKLAHOMA NO. 54



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

OKMULGEE COUNTY, OKLAHOMA NO. 55


(Joins sheet 52)
R. 12 E.
R. 13 E.
56
N
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 59)
T. 11 N.
Spelter City
Dewar
Henryetta
Webster School
Roosevelt School
Bald Knob
ST LOUIS SAN FRANCISCO
OKLAHOMA AND GULF
KANSAS
Coal Creek
PROPOSED
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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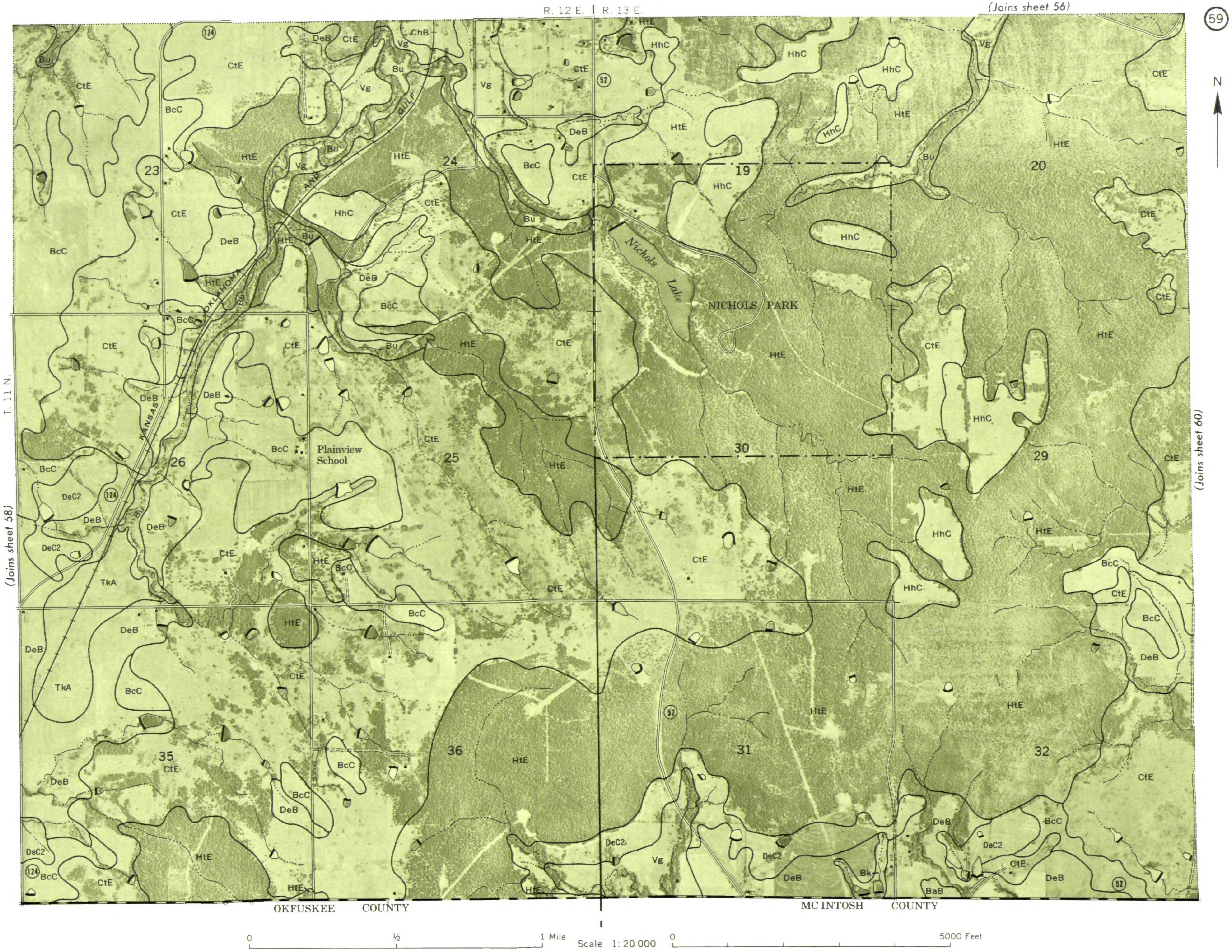
OKMULGEE COUNTY, OKLAHOMA NO. 57

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



OKMULGEE COUNTY, OKLAHOMA NO 59

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet